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REPORT

TO THE

GOVERNMENT OF MADRAS

ON THE

INDIAN PEARL FISHERIES

IN THE

GULF OF MANNAR

BY

JAMES HORNELL, F.L.S.,

Marine Biologist to the Government of Ceylon and Inspector of Pearl Banks.

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PREFACE.

The accompanying report upon the present condition and future prospects of the Pearl Banks off the Coast of Madura and Tinnevelly is the outcome of a request for the loan of my services made by the Government of Madras to that of Ceylon in the Spring of 1904.

I appreciate most highly the honour thus done me and I have endeavoured to the utmost of my ability to discharge satisfactorily the duty laid upon me. The working up of the material, however, proved unexpectedly tedious and arduous; the volume of the material to be digested was very much greater than I had anticipated; wide historical enquiries had to be instituted and all this to be carried on concurrently with the exacting duties of my first year in office as Inspector of Pearl Banks and Marine Biologist to the Government of Ceylon. Critics will therefore, I trust, deal gently with the many shortcomings which I am conscious mar the present report; they will kindly bear in mind that it has been built up largely in fragments of time snatched from an all too scanty leisure. I should like indeed to devote further study to the enquiry, but under present circumstances, I see no prospect of the necessary time-opportunity. I reluctantly decide that it is better to send in the report as it stands than to postpone its issue indefinitely.

Possibly I have striven to do more than was expected from me, but having put my hand to the work I could not refrain from the attempt to review the position in all its bearings. However many shortcomings pertain to this effort I have cleared some stumbling blocks from the way and have indicated the lines on which success may be attained eventually by the workers who will follow me.

My aim has been to sift the whole of the evidence available, historical, zoological and physiographical; to present the conclusions in a simple and succinct form and to formulate remedial measures on a practical and business-like basis.

It has not been found necessary to treat herein of the anatomy and habits of the pearl oyster as such are dealt with fully by Professor Herdman and myself in the "Report on the Pearl Oyster Fisheries of the Gulf of Mannar," recently published by the Royal Society.

My grateful acknowledgements are made to my predecessors in this investigation; my work has been immensely facilitated by the extensive data recorded and ably presented in Mr. H. Sullivan Thomas' "Report on Pearl Fisheries" published by the Madras Government in 1884, and in the valuable reports made from time to time by Dr. E. Thurston in the Bulletins of the Madras Museum. It has always appeared to me a thousand pities that Dr. Thurston's abilities have not been utilized to a much greater extent than they have been in Pearl Fishery investigation, seeing how highly qualified he has proved himself for the task.

I am also pleased to have this opportunity to thank Captain Carlyon, the Port officer of Tuticorin and Superintendent of Pearl Banks, and Don Gabriel de Cruz Lazarus Motha Vas, the Jati Talaivan of the Parawas, for their courtesy and help during the actual work of inspection in May 1904. The Jati Talaivan, indeed, spared no pains to put me in possession of all the historical and traditional information of which he is the depositary owing to the close connection which has existed for centuries between his forefathers and the Pearl Fishery organization; such has been of great value to me.

The Pearl Banks, Ceylon,
28th March 1905.

JAMES HORNELL.

REPORT ON THE INDIAN PEARL FISHERIES IN THE GULF OF MANNAR.

I

HISTORICAL SURVEY OF THE PEARL FISHERIES OFF THE MADURA COAST. *

The well-known lack of the historical faculty among the peoples of India prior to the advent of Muhammadanism involves us in all but utter ignorance of the exact localities, course, and conduct of the pearl fisheries of the Gulf of Mannar, as well on the Ceylon as on the Indian side, until the date when European control began.

Anterior to the Portuguese seizure of the fisheries in 1524,† the glimpses we catch are hazy and unsatisfactory—glimpses recorded on their return home by sailors and travelling merchants belonging to other countries. Greeks, Egyptians, Barbary Moors, Arabs, Venetians and Genoese have all referred incidentally to these fisheries as among the notable sights seen during their journeyings, whereas Tamil and Singhalese writers had no thoughts save for the glory and exploits of their kings and the advancement and excellence of their religious systems. The latter refer to pearls solely to utilise the idea of their beauty and the mystery of their origin for the purposes of their exuberant and florid imagery and in the exaggerated descriptions of the riches of their kings and temples.

When the pearl fisheries of the Gulf of Mannar were first exploited we have no hint; even two thousand years ago they were celebrated throughout the known world from China to the Mediterranean. In Rome, in the days of Pliny, pearls from the Gulf of Mannar were valued at a high price and Pliny refers to this fishery as the most productive of pearls of all parts of the world, while more than six centuries before (550 – 540 B.C.), Wijaya, the Aryan Conqueror of Ceylon, is said to have included rich offerings of pearls among the presents to his father-in-law, the Pandyan King of Madura. ‡

The earliest definite reference to a particular locality in the Gulf of Mannar where a fishery was carried on, occurs in the "Periplus of the Erythraean Sea", written about the end of the first century A. D. by an Alexandrian Greek. In a description of the ports on the Indian Coast, he writes—

"Upon leaving § Ela-bakara or the Ruddy Mountain, the country which succeeds "is under the Government of Pandian; it is called Paralia (Purali) and lies almost "directly north and south; it reaches to Kolkhi in the vicinity of the pearl fishery. "But the first port after leaving the Ruddy Mountain is Balita and next to that is "Komar which has a port and a harbour . . . . From Komar the district extends "to Kolkhi and the pearl fishery which is conducted by slaves or criminals condemned "to the service, and the whole southern point of the continent is part of Pandyan's "dominion. The first place that succeeds after leaving Kolkhi is the Bay Argulus "connected with a district inland (of the same name). Here and here only the pearls "obtained in the fishery at the island of Epidorus ‖ are perforated and prepared for the "market and from the same island are procured the fine muslins sprinkled with "pearls."

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* The term "Madura Coast" is employed in these pages, unless it be specified otherwise, in its wider and more ancient sense; it signifies here the sea board of the ancient Kingdom of Madura and therefore includes the shore of the modern district of Tinnevelly as well as that of the Madura district.

† Gaspar Correa, "Lendas da India", volume II.

‡ *Vide* the "Mahawansa."

§ Vaikkarai in the Cochin district.

‖ Most probably this is the island of Mannar, formerly the head-quarters of the Ceylon Pearl fishery.

Ptolemy (who died in 163 A.D.) adds further interesting references, mentioning in his description of the provinces, towns, and rivers of the East Coast—

"Country of the Kareoi; in the Kolkhic gulf, where there is the pearl fishery, "Sôsikourai and Kolkhoi, an emporium at the mouth of the river Solen."

So unchanging are names and peoples in this district that at the present day the majority of these names can be readily recognised—in itself also a tribute to the accuracy of the two Græco-Egyptian geographers of 1800 years ago. Komar is obviously Kumari anglicised into Comorin: the Kareoi are the caste of Karaiyar or coast people—fishermen and boatmen—of whom the Parathavar or Parawas are a branch or section, described in the Tamil poem "*Maturaik-kanchi*" (LL. 140—144) * as men who dived for pearls or for conch shells and knew the charm to keep off sharks from that part of the sea where they dived.

The town of Sôsikourai has, I notice, not been identified by any writers with any now-existing place name, but I have little doubt it represents Tuticorin—the present principal town on the coast. The Tamil S is commonly corrupted into Ch, as Sippi into Chippi, and then Chôchikourai would readily pass into Tōtikourai and Tūticourai from which Tuticorin, the present rendering of the name of this town, is readily derivable.

Of Kolkhi, identified by the Græco-Egyptian writers as the head-quarters of the pearl fishery, no name trace remains, even in that of a decadent village. The localisation is however rendered easy by reference to the Tamil poems of the period in question. In them is frequent mention of the great city of Korkai. Thus the "Maturaik-kanchi" describes it as the chief town in the country of the Parathavar and the seat of the pearl fishery, with a population consisting chiefly of pearl-divers and chank-cutters. The great epic "Chilappatikaram" (XXVII. 127) further records that on account of the importance of the revenue derived from the pearl fishery, Korkai was a sub-capital of the Pandyan Kingdom, and the usual residence of the heir-apparent. In its prime it boasted great magnificence, adorned with temples and palaces befitting its wealth and importance. It was situated at the mouth of the river Tambraparni † a river draining the present district of Tinnevelly and carrying down to the sea immense quantities of sand.

The harbour of Korkai gradually silted up, and deltaic accumulation eventually cut off ready access to the sea. In consequence the old city gradually decayed and the population drifted to the new mouth of the river where a daughter town sprang into being at the expense of the parent. Exactly when this occurred I cannot make out. Mediæval travellers make no mention of Korkai or Kolkhi: the head-quarters of the Indian Pearl fishery still remained located at the mouth of the Tambraparni, but its name was altered to Chayl, Cail, or Kayl, wherein we recognize the Kayal of to-day.

Marco Polo in the thirteenth century speaks of Cail as a great and noble city; Ludovico de Vathema mentions that he saw pearls fished for in the sea near the town of Chayl in about A.D. 1500, while Barbosa, who travelled about the same time, says that the people of Chayl are jewellers who trade in pearls.

To-day Kayal is a miserable village some miles inland and situated four or five miles northward of Pinnacoil, a Parawa town on an island in the present embouchure of the Tambraparni. The old name still clings, and the ruined remains of what must have been the great buildings of a noble city are within gunshot—the old Kayal and possibly the Korkhi of classic geographers and the Korkai of the ancient Tamil epics.

Kanakasabhai in his "*Tamils of* 1800 *years ago*"‡ appears to think Kayal and Korkai were separate cities, saying, "The site of this town (Korkai) which stood on

* Probably written about the same time as the "Periplus".

† This name Tambraparni in its Romano-Greek form of Taprobane was also the accepted cognomen of the island of Ceylon among the Romans of the empire. Variations in the manner of spelling are many—Tambrapurni, Tamraparni, Tambrapanni, Vamrapanni and others.

Much ingenuity has been displayed (and wasted) in seeking plausible derivations. All those quoted in Tennent's "Ceylon" seem to be purely fanciful; I do not think we need go beyond the terms *Tambiram*, copper, and *Varnam*, or *Parnam*, colour, words in common use among Tamils, in seeking for the meaning of the name.

No feature strikes the stranger on arrival in Colombo more forcibly than the copper-red hue of the roads and soil: "Copper-coloured Isle" is a most appropriate descriptive term to apply to Ceylon and equally so is the "Copper-coloured water" to the Tinnevelly river in question, when in flood it becomes turbid with the red mud it carries seawards.

‡ Madras, 1904.

the sea coast is now about five miles inland. After the sea had retired from Korkai, a new emporium arose on the coast. This was Kayal . . . . which in turn became in time too far from the sea and Kayal was also abandoned."

The accuracy of this statement I have no means of judging, except that none of the people of the Tambraparni district whom I have met have any knowledge of the ruins of Korkai, whereas they all know those of Kayal, and we have ample evidence that the abandonment of Kayal and the creation of the new ports and daughter towns of Kayalpattanam and Pinnacoil, or more properly Pinnekayal, by the Moor and Parawa inhabitants respectively of Kayal took place in early Portuguese times as will be noted further on.

When the Portuguese rounded Cape Camorin they found the pearl fisheries of the Gulf of Mannar in the hands of the caste of shore-dwelling people, fishermen and divers, already alluded to as Parawas whom tradition shows to have had control of this industry from time immemorial. Of the origin of these people we know extremely little. We know, however, that in the old days, from 600 B. C. and for 1,500 years or more thereafter, the country now comprehended in the districts of Madura and Tinnevelly, formed the great Tamil Kingdom of Pandya, and in the old Tamil work called the "*Kalveddu*" the position of the pearl-fishing caste to this monarchy is incidentally mentioned in the following extract,—

"Vidanarayanen Cheddi and the Paravu men who fished pearls by paying "tribute to Alliyarasani, daughter of Pandya, King of Madura, who went on a voyage, "experienced bad weather in the sea, and were driven to the shores of Lanka, where "they founded Karainerkai (Karativo) and Kutiraimalai. Vidanarayanen Cheddi had "the treasures of his ship stored there by the Parawas, and established pearl fisheries "at Kadalihilapam (Chilavaturai) and Kallachihilapam (Chilaw) and introduced the "trees which change iron into gold", etc., etc. (Herdman, "Report on the pearl oyster "fisheries of the Gulf of Mannar", volume I, page 2).

In the "*Maturaik-kanchi*" they are described as being most powerful in the country round Korkai, "well-fed on fish and flesh and armed with bows, their hordes terrified their enemies by their dashing valour.* " It is very probable that they were of Naga origin and of the same race as the inhabitants of Ceylon at the time of the Wijayan conquest of that island.

When the Pandyan kingdom was powerful the Parawas had grants of certain rights from the monarchy, paying tribute from the produce of the fisheries and receiving protection and immunity from taxation in return. The fishery in these early days appears to have been extremely prosperous—thus in A.D. 1330 Friar Jordanus, who visited India at this time, tells us that as many as 8,000 boats were employed in the pearl fisheries of Tinnevelly and Ceylon †.

The organization of the fisheries was also well ordered even prior to the advent of Europeans, as we learn from the following extract written by the Nawab of the Carnatic in 1771 to the Governor-General of Batavia, namely—

"In the time of the King of Madura, Terniel Nadu Raja and the second king "Minaatje Ringeja Dalway, in the year 1470 it was decided that in January all things "connected with the fishery should be arranged and that the same arrangement should "hold good so long as the kingdom remained under the Carnatic. ‡"

The conditions under which the Parawas lived and the far-reaching changes which at this period—the opening of the 16th century—were beginning to be felt owing to the weakening of the paramount power of Vijayanagar are graphically set forth in a report, dated 19th December 1669, written by Van Reede and Laurens Pyl, respectively Commandant of the Coast of Malabar and Canara and Senior Merchant and Chief of the sea-ports of Madura, in justification of their action in undertaking war with the Nayak or King of Madura. This report addressed to Van Goens, the Governor of Ceylon and Dutch-India, contains the following exposition of the

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* Kanakasabhai, loc. cit., page 44.
† Thurston, E. "Pearl and Chank Fisheries;" Mad, 1894, p. 9.
‡ At this period the kingdom had lost its independence and was tributary to the great Hindu state of Vijayanagar, which comprised the region known as the Carnatic.

condition of the Parawas prior to the arrival of the Portuguese, and the manner in which the Portuguese obtained possession of the fisheries and subsequently carried them on:—

"Under the protection of those Rajas there lived a people, which had come to "these parts from other countries *—they are called Parruas—they lived a sea-"faring life, gaining their bread by fishing, and by diving for pearls; they had "purchased from the petty Rajas small streaks of the shore, along which they settled "and built villages, and they divided themselves as their numbers progressively "increased.

"In these purchased lands they lived under the rule of their own headmen, "paying to the Rajas only an annual present, free from all other taxes which bore "upon the natives so heavily, looked upon as strangers, exempt from tribute or "subjection to the Rajas, having a chief of their own election, whose descendants are "still called Kings of the Parruas, and who drew a revenue from the whole people "which in process of time has spread itself from Quilon to Bengal. Their importance "and power have not been reduced by this dispersion, for they are seen at every "pearl fishery (on which occasions the Parruas assemble together), surpassing in "distinction, dignity and outward honours, all other persons there, and still bearing "their own appellation.

"The pearl fishery was the principal resource and expedient from which the "Parruas obtained a livelihood, but as from their residence so near the sea, they had "no manner of disposing of their pearls, they made an agreement with the Rajas that a "market day should be proclaimed throughout their dominions, when merchants might "securely come from all parts of India, and at which the divers and sutlers neces-"sary to furnish provisions for the multitude might also meet, and as this assemblage "would consist of two different races, namely, the Parruas and subjects of the Rajas, "as well as strangers and travellers, two kinds of guards and tribunals were to be "established to prevent all disputes and quarrels arising during this open market, "every man being subject to his own judge, and his case being decided by him; all "payments were then also divided among the headmen of the Parruas, who were the "owners of that fishery, and who hence became rich and powerful; they had weapons "and soldiers of their own, with which they were able to defend themselves against "the violence of the Rajas or their subjects.

"The Moors who had spread themselves over India, and principally along the "coasts of Madura, were strengthened by the natives professing Mahomedanism and "by the Arabs, Saracens, and the privateers of the Sammoryn †, and they began also "to take to pearl-diving as an occupation, but being led away by ill-feeling and hope "of gain, they often attempted to outreach the Parruas, some of whom even they "gained to their party and to their religion, by which means they obtained so much "importance, that the Rajas joined themselves to the Moors, anticipating great "advantages from the trade which they carried on and from their power at sea; and "thus the Parruas were oppressed, although they frequently rose against their adver-"saries, but they always got the worst of it, until at last in a pearl fishery at "Tutucoryn, having purposely raised a dispute, they fell upon the Moors, and killed "some thousands of them, burnt their vessels, and remained masters of the country, "though much in fear that the Moors, joined by the pirates of Calicut, would rise "against them in revenge.

"The Portuguese arrived about this time with one ship at Tutucoryn; the "Parruas requested them for assistance, and obtained a promise of it, on conditions "that they should become Christians; this they generally agreed to, and having sent "Commissioners with some of the Portuguese to Goa, they were received under the "protection of that nation, and their Commissioners returned with priests, and a "naval force conveying troops, on which all the Parruas of the seven ports were "baptized, accepted as subjects of the King of Portugal, and they dwindled thus from "having their own chiefs and their own laws into subordination to priests and

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* This is most improbable; they are more probably the descendants of Naga fishermen settled in the district prior to the immigration of Tamil invaders.

† The Zamorin of Calicut, a powerful sea-chief of this period, but himself belonging to the Hindu religion.

"Portuguese, who however settled the rights and privileges of the Parruas so firmly, "that the Rajas no longer dared interfere with them, or attempt to impede or abridge "their prerogative; on the contrary they were compelled to admit of separate laws "for the Parruas from those which bound their own subjects. The Portuguese kept "for themselves the command at sea, the pearl fisheries, the sovereignty over the "Parruas, their villages and harbours, whilst the Naick of Madura, who was a subject "of the King of the Carnatic, made himself master at this time of the lands about "Madura, and in a short time afterwards of all the lower countries from Cape Comoryn "to Tanjore, expelling and rooting out all the princes and land proprietors, who were "living and reigning there; but on obtaining the sovereignty of all these countries, "he wished to subject the Parruas to his authority, in which attempt he was opposed "by the Portuguese, who often, not being powerful enough effectually to resist, left "the land with the priests and Parruas and went to the islands of Mannar and Jaffna-"patam, from whence they sent coasting vessels along the Madura shores, and caused "so much disquiet, that the revenue was ruined, trade circumscribed and almost "annihilated, for which reasons the Naick himself was obliged to solicit the Portu-"guese to come back again.

"The Political Government of India, perceiving the great benefit of the pearl "fishery, appointed in the name of the King of Portugal military chiefs and captains "to superintend it, leaving the churches and their administration to the priests. "Those captains obtained from the fisheries each time a profit of 6,000 rixdollars for "the King, leaving the remainder of the income from them for the Parruas; but seeing "they could not retain their superiority in that manner over the people, which was "becoming rich, luxurious, drunken, with prosperity, and with the help of the priests, "who protected them, threatening the captains, which often occasioned great dis-"orders, the latter determined to build a fort for the King at Tutucoryn, which was "the chief place of all the villages; but the priests who feared by this to lose much "of their consequence as well as of their revenue insisted that if such a measure was "proceeded with, they would all be ruined, on which account they urged on the "people to commit irregularities; and made the Parruas fear that the step was a preli-"minary one to the making all of them slaves; and they therefore raised such "hindrances to the work that it never could be completed.

"We have considered it worth while to prefix to our narrative this notice of old "times, because it may throw some light on the present difficulties, and afford also a "clear proof of the right which the Honourable Company at present claims over the "Christian natives and all that relates to them.

"The Netherlands East India Company began about the year 1644, when it "had obtained possession of some places on Ceylon, to carry on trade and commerce "with the countries of Madura, and made a treaty for that purpose with the above-"mentioned Naick, stipulating,

"'That the Honourable Company might trade in his territories with security "and freedom, to which end a dwelling or lodge at Cailpatnam was allowed them, as "may be seen by the treaty or contract in possession of the Company'—and on this word "and faith of the Naick their trade began, and their goods, merchandize and servants "were confidently left in protection of their ally—but where there is no firm ground "of integrity, treachery and faithlessness find easy entry.

"This the Company soon experienced, for it was not long ere this evil-minded "and wicked people, deceived by appearances, and induced by hope of rapine and "profit, forgot their faith and promises, suffering themselves to be seduced by a sum "of money to demolish the Company's lodge, seize its goods, and murder its servants; "in which last attempt however they failed by the unexpected appearance of a ship "in which the men took refuge and thus wonderfully escaped. This dastard villany, "detestable in any prince or chieftain, the Portuguese had contrived, and effected by "means of the Parruas and the Naick's servants who thought the neighbourhood of "the Company injurious to their interests. And although in the year 1649, a signal "vengeance fell as well upon Tritchenadoor as Tutucoryn, yet the people, and their "master, the Naick and his Government remained equally base, taking every oppor-"tunity to exercise oppression. Even the Portuguese whom they had assisted to do "harm to the Company began soon to perceive that the renters and chiefs of the

"lowlands wronged the Parruas on all sides and diminished the right of the Portu-
"guese, but at that time they had no means of preventing it, as the Dutch Company
"was increasing in strength and were taking possession of their towns, forts and ships,
"and became daily more powerful, which caused them to bear much from the Naick
"with forbearance.

"Matters stood thus in the hands of the Naick of Madura * till 1658, when
"the town of Tutucoryn was taken by force of arms from the Portuguese and Parruas,
"by which success the Company succeeded to their rights over the coast, as well as to
"their authority over the sea-ports, the Christians, the pearl fisheries, and all there-
"unto appertaining; in fact to all that the Parruas first had, and the priests and
"Portuguese afterwards possessed."

Of the prosperity and conduct of the fisheries under the Portuguese we know nothing with exactitude—even the dates of the important fisheries are lost through the disappearance of the official records.

Fortunately many of the Portuguese soldiers of fortune have left memoirs of their lives in the east, and several furnish interesting accounts of the conduct and management of the fisheries at this time. The two most important are those left by Gaspar Correa and by Juan Ribeyro; the former dealing with the condition of the fishery at the beginning of the Portuguese connection, the latter with an account of it in the years when his nation was being dislodged foot by foot and fort by fort from Ceylon and India by the Dutch. Both are worthy of being better known and therefore it will be better to give the extracts in full.

Gaspar Correa's account † tells us that in the year 1523 the King of Portugal commissioned Manuel de Frias to make inquiries in India regarding the tomb of the apostle Thomas, and it proceeds thus:—"And he commanded that with him should go
"João Froles, who had taken part in the affairs in Ceylon when Lopo Soares went
"there, and who had been appointed by the King captain and factor of the pearl fishery
"which is carried on by the natives of the country between Ceylon and the Cape of
"Comoryn; in former times the Moors of that coast had possession of this pearl
"fishery, for which they paid a large rent to the lords of the land, wherefore the
"Governors had a good right thereto, since they were rulers of the sea. Therefore
"now João Froles having come thus commissioned that he might take possession of
"and receive for the King this fishery, so that the Governor might not suffer loss by
"not being able to receive it for himself, he did not give João Froles the fleet and
"men that the King had commanded, and in order to get from it whatever he could
"gain he ordered Manuel de Frias to go to the fishery, and to rent it for whatever
"the lords of the land would give, and this in order that he might find out what it
"would yield, and having accomplished this that he should proceed to the coast of
"Choromandel as captain and factor."

A little further on we read:—"Manuel de Frias, captain and factor of Choromandel,
"in accordance with the orders of the Governor, which he carried with him, placed
"João Froles over the fishery which he rented out to the *digares*,‡ of the country for
"one thousand five hundred *cruzados* per annum, and left there as factor João Froles,

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* Dravida, the country of the Tamils, was divided in the earliest days of which we have record and prior to the Christian era, between three dynasties, the Pandyans, the Cheras, and the Cholas. The Pandyan kingdom, deriving its name from that of the founder of the first dynasty, comprised under normal conditions little more than the present districts of Madura and Tinnevelly, the city of Madura being the capital during the greater part of the continuance of the kingdom, which suffered the usual vicissitudes of Indian states, sometimes preponderating and more frequently, in later times, tributary to a neighbouring state, but always maintaining in Madura some semblance of sovereign authority.

After the fall of the powerful Bilal Rajas, at the beginning of the fourteenth century (A.D. 1310), a great Hindu state, that of Vijayanagar, took shape in the centre of the Deccan. The Raja of this state became about the middle of the fourteenth century the overlord of the states of Southern India including the Pandyan country, and the Princes of Madura remained tributary till about the time of the arrival of the Portuguese in the Gulf of Mannar.

The reigning dynasty at that time was that of the Nayaks, and while the Portuguese were busy making settlements on the coast, the Nayak was making himself master of all the lower countries from Cape Comorin to Tanjore, "expelling and rooting out all the princes and land proprietors" who were living and reigning there.

The battle of Talikota in 1565, in which the last Raja of Vijayanagar fell before a great combination of Muhammadan states, gave the Nayak complete independence, which his family retained till 1736 when the last of this house fell before the power of the Nawab of the Carnatic, the ally of the British.

† "Lendas da India."

‡ Evidently *Adigars* are meant. At the present day the principal headman of the pearl fishery district in Ceylon (Musali) is officially known by this title of Adigar. It is this officer who is charged with the details incident to the erection of the fishery camp prior to each fishery.

" with his clerk, in a large boat well armed; and in order that the factor might not be " able to steal any of the money from the rent of the fishery, he took other measures, " obtaining from the fishers themselves the pearls, whereby he committed many " robberies, as is done nowadays; for the ills of India are not improving, but are " increasing continually, as I shall recount further in speaking of the end that this " João Froles came to at this fishery, in which he paid for a portion of the evils that " he had committed."

An interval of over three years then elapses before we again hear of the pearl fishery, Lopo Vaz de Sampayo being then Governor in India. We read that in January 1528:—

" Manuel da Gama was appointed by the King as captain of the coast of Coro- " mandel, and João Froles as captain and factor of the pearl fishery. This act of " friendship towards Manuel da Gama was managed by Hector Da Silveira before he " departed; and the Governor gave him a ship and four foists well fitted and armed, " as he had had tidings that paraos of Calicut were going along the coast of Paleacate " committing great robberies, and had seized a ship that had come from Malacca very " richly laden, with eight Portuguese whom they put to death. To this Manuel da " Gama retaliated so well, that he cleared the coast of the robbers, and managed to get " back on land all the goods from the ship which the robbers had sold, and many male " and female slaves of the Portuguese whom they had killed on board the ship; " which robbers went over to Ceylon with much booty, and joined the others who had " gone from Calicut, and went about robbing as much as they liked by sea and land. " The Governor sent to João Froles as captain and factor of the fishery, in a caravel " and a large boat and three foists, with which he went about collecting the rent of " the fishery, as I have already said. This being known to the robbers, who went " about strongly armed with artillery and men, twenty of them came in a body to " attack João Froles as Manuel da Gama had gone to the other coast and could not help " him and they came upon João Froles who was in the caravel, with the large boat, " the foists having gone to another place; and as they were moored and the wind was " calm, twelve of the paraos made for the caravel, dividing into six on each side, and " the other eight likewise divided to attack the large boat. João Froles, seeing the " paraos preparing for the attack, made ready as well as he could with twenty Portu- " guese men that he had, and threw a rope to the large boat, so that the two lay stern " to stern. Six Portuguese men went into the large boat: the caravel had a *camello* " and two falcons and six *bercos*,* and the large boat, two falcons and six *bercos*, but " there were only a few men as several had gone to the foists that João Froles had " sent to the coast of Ceylon as prizes. Our men having thus got ready, the *paraos* " divided into two attacking parties, ten approaching from each side avoiding the shots " from the camello, and shifting as they pleased, all the while discharging from " *roqueras* * iron balls of the size of quinces, and firing as they liked they gave the " caravel and large boat so many shots, that they cut their shrouds and caused them " to fall with the yards, at which they set up loud shouts. Neither João Froles nor " the master of the caravel had thought of putting belts under the yards, which if they " had done the yard would not have fallen. At this the Moors considered themselves " victors, as the Portuguese were already killed or wounded, for only the falcons and " *bercos* were now of any use to our men, and they did not fire them so often as did " the Moors, and our men were continually becoming less able to fire; wherefore the " Moors knowing the weakness of our men came in a body with their arms, and their " shouts and war charges, and boarded the vessel, and killed as many as they found " alive, without sparing any one, and carried off all that they found, and took the " falcons and *bercos* and ammunition, and set fire to the vessels so that they went down, " and then returned to Ceylon. Our foists, hearing the news of the burning of those " vessels, fled to where Manuel da Gama was staying."

The description of the conduct of the fishery under the Portuguese by Juan Ribeyro in his " History of Ceylon," dated 1685, is the only detailed account handed down to us.†

* Different kinds of cannon.

† From the English translation from the French version of the Abbé Le Grand, Ceylon, 1847.

It runs as follows :—

"Having now related all that we know of the natural riches of the land of "Ceylon, we shall describe those which its sea produces. The pearls which are procured "from the coasts of the island, and more especially from Aripo, are of the highest value. "As few persons know how that fishery is conducted, we shall here relate what we "know of it.

"At the beginning of March there assemble on that coast 4,000 or 5,000 boats "got together and paid by Moorish or Heathen merchants and by some Christians.* "These merchants have many partnerships among themselves, and they first make up "a fund to arm four, five or six boats, more or less, according as the entire adventure "is greater or smaller. Each of these boats has generally from ten to twelve sailors, "one master and eight or nine divers. All the boats go out together, and seek where "the fishery is likely to be most profitable : and they anchor at the spots where the "sea is only five, six or at most seven fathoms deep. Then they send off three boats "to a league distant round about, each in a different direction ; each of these boats "brings back a thousand oysters. These are opened in presence of the merchants and "the pearls found in them are examined by the whole party and their value estimated, "as the pearls are much finer in some years than in others; and accordingly as the "merchants find the pearls to be large, clear, round and of good water, they bargain "with the King for the fishery of that year. When the bargain is made the King "usually gives them four vessels of war to defend them from the Malabar and other "pirates. Then each merchant goes to the sea-side and constructs a sort of enclosure "with stake and thorns, only leaving a narrow passage for the boats to enter and go "out again, which come there to discharge the oysters they have fished up.

"On the 11th of March, at four in the morning, the officer in command of the "four vessels of war fires a gun as a signal, and immediately all the boats put off to "sea, steering for the place which they have selected to fish at and casting anchor "there. Each of these boats has on board stones of the weight of 60 lb. each, "fastened with strong ropes, of which one end is attached to the boat. The diver "places his foot on one of the stones, and passes another rope round his body, to which "is tied a basket or a small woven bag like a net ; this second rope is held by two of the "sailors, and the diver thus secured descends into the sea ; he remains there whilst "two *credos* can be said, and fills his little bag or basket with oysters which he "sometimes finds in heaps on the rocks ; as soon as his basket is full, he makes a sign "by pulling the rope held by the sailors in the boat, and one end of which is round his "waist, and they draw him quickly out of the water ; but if in the time he is below, "he can contrive to open an oyster and finds a pearl in it, it is considered his own ; † "as soon as his head is above water another diver goes down, and thus they descend "by turns. This fishery lasts till four in the afternoon, when the officer in command "fires another gun as a signal to cease the fishery for the day. Then all the boats go "to their several enclosures, and the noise and confusion that ensue in the two hours "that are allowed to discharge and pile up the oysters cannot be described.

"Besides the people belonging to the boats the children of the neighbourhood "never fail to assemble at the sea-side, offering their services, rather however to steal "the oysters than to assist the sailors or merchants. As soon as the boats are "unloaded they put to sea again, and go about half a league higher up by the sea-side, "where the merchants assemble and hold a splendid fair ; there are magnificent tents "and all sorts of merchandise of the most valuable kind are to be had there, as vendors "come from all parts of the world. Heathens, Jews, Christians and Moors, all have "some speculation for profit ; some sell by wholesale, others by retail ; the sailors and "children bring the pearls which they have stolen, and people of every kind have "bargains to offer. Persons having but a small capital buy small ventures, which "they immediately sell to larger merchants with a middling profit ; not only pearls "are bought and sold, but jewellery of every kind, bargold, dollars, fine Turkey "carpets, and beautiful stuffs from India.

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* An escort of armed men always accompanies the pearl divers, on account of the Malabars, who come from the coast of that name or from the Maldives, and who live by piracy, so that no boat, canoe or prahu is safe in those seas. The fishers or divers cease their work at noon, on account of the swell caused by the wind, and which annoys the divers, who can only descend in calm weather. (Note by the French translator.)

† This is an error in translation and in fact. In translation from the original Portuguese it reads, "the diver as soon as he rises to the surface is at liberty, until he who is at the bottom of the sea ascends, to open with a knife as many oysters as he can and whatever he finds therein is his."

"The fishery lasts from the 11th of March to the 20th of April,* but the fair "itself continues for fifty days, because for the last nine days the enclosures are "cleansed, as so many flies are bred by the corrupt matter that the adjacent places and "the whole country might be annoyed by them, if care were not taken to sweep into "the sea the impurities collected during the fishery.

"On the last day of April, the merchants of the several partnerships assemble "together and share the pearls belonging to their respective boats. They separate "them into nine classes, and set on each class a price according as the demand has "been greater or less for pearls during the year; when these prices have been set on "them, they make the allotments and shares. Then the ill-formed pearls are sold at a "sufficiently moderate price; the small seed-pearls are left on the sea-side and the "country people come in the spring and sift the sand for them and sell them for a "trifle.

"Hence the pearls and seed are sent to all parts of the world. This is all I know "of this fishery. But I must not forget to add that pieces of *amber* of a considerable "size are also found on this coast. Great branches of *coral* also drift ashore when the "sea is high; the black kind is better and more esteemed than the red."

In no Portuguese work have I found any indication of the frequency of the recurrence of fisheries under the Portuguese or of the approximate values and localities of each, a lack of knowledge greatly to be regretted as it becomes impossible to say with certainty whether or not there has been deterioration, progressive or intermittent, in the oyster-producing qualities of the beds. The only hint I have come across is a chance remark in Ribeyro's "History", to the effect that the inhabitants of Mannar had in his time (circa 1658) become impoverished by the decadence of the pearl fishery on the Ceylon coast and its transference to the Tuticorin side, his words being "at present the oysters have migrated and are to be found on the coast of Tuticorin." †

Even prior to the Portuguese we find the uncertainty of the pearl fisheries a matter of notoriety for Albyrouni who served under Mahmoud of Ghazni and wrote in the eleventh century, says that the pearl fishery which formerly existed in the Gulf of Serendib, had become exhausted in his time simultaneously with the appearance of a fishery at Sofala, in the country of the Zends, where pearls were unknown before, and remarks that hence arose the conjecture that the pearl oyster of Serendib had migrated to Sofala ‡, *i.e.*, to the Persian Gulf.

Few other facts of importance are to be gleaned from Portuguese writers. We see however that in fulfilment of the treaty made with the new-comers the Parawas became zealous Roman Catholics. Thus they won the confidence of their masters and under the protection of the priesthood enjoyed a comparative tranquillity and immunity from extortionate tyranny seldom met with by Indians living within the Portuguese influence.

St. Francis Xavier did great work among the the Parawas and it was on the fishery coast at or about Pinnacoil that he commenced his missionary labours in 1542, thereafter visiting Tuticorin and sending priests to Mannar at the earnest solicitation of the inhabitants. §

That the fisheries were then flourishing is betokened by the fine churches and great monasteries that rose at the three centres named from the offerings and profits of the divers and merchants during the second half of the sixteenth century.

The Portuguese appear to have kept well in hand the petty Rajas whose territories abutted on the fishery coast and to have been able to afford efficient protection to the Parawas. They were fortunate in arriving in India at a time when the native states were in the crucible of change, when internecine warfare left the chiefs neither time nor power to cope efficiently with a more highly organized foe from oversea. Old

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* Old style ?

† See also Baldaeus' "Description of Malabar and Coromandel," English edition, London 1703, where in volume 3, page 792, referring to the condition of affairs in 1658, he states that "this island (Mannar) was formerly celebrated for the pearl fishery as well as the city of Tutecoryn; but no pearls having been taken there for these ten years last past, the inhabitants are reduced to great poverty; whereas the sumptuous edifices, churches and monasteries, with their ornaments, are sufficient demonstrations of its former grandeur."

‡ Reinaud's "Fragmens Arabes," page 125, quoted by Tennent in "The Natural History of Ceylon," page 375.

§ "The History of Ceylon" by Philalethes, London 1817, page 224.

states were in the melting pot of invasion and insurrection and especially was this true of Southern India, where political paralysis began to affect Vijayanagar—beginning, as is usual, in those provinces furthest from the centre of the state.

The latest dynasty—the Nayaks—occupying the tributary throne of Madura was beginning to assert independence of the central Government from which it became entirely free when the battle of Talikota in 1565 completed the destruction of the Suzerain Hindu State of Vijayanagar.

The Parawas as already mentioned although the original holders of the fishery rights had begun prior to the arrival of the Portuguese to feel the competition of the restless Muhammadan settlers on the coast, who, coming as many must have done, from the coasts of the Persian Gulf knew already all there was to know of pearl fishing. The descendants of these Arabs and their proselytes, known as Moros to the Portuguese, are the Moormen or Lubbais of to-day. * Their chief settlement was Kayal, a town situated near the mouth of the river Tambrapurni, and which in Marco Polo's time (1290–91) was "a great and noble city". It shared with Tuticorin for fully 500 years the honour of being one of the two great pearl markets of the coast—the one being the Moor, the other the Parawa head-quarters.

Hating the Moormen with all the fanatical intolerance which was their curse and the chief cause of their eventual ruin the Portuguese took the part of the Parawas. Accordingly the Nayak of Madura, Hindu though he was, lent his influence to the Moors of Kayal in the hope of eventually being in a position to drive out the Portuguese and so obtain control of the coveted pearl fishery. None of the Nayaks were ever strong enough to do this and an armed neutrality usually existed, the Portuguese even granting certain privileges—practically tributes—to the Nayak's Government in return for facilities given to the pearl merchants to travel without exactions to the scene of the fishery.

The chief item in the concession made to the Nayak was the grant of a number of free boats in each fishery. A grant engraved upon copper made by Sockalingee Teroomalee Nayak in favour of the Modeliar Pilly Marcair, the head of the Moorish community,† on founding the town of Kayalpattanam furnishes an interesting light on the details of this arrangement.

It appears that the new town of Kayalpattanam had become a necessity through the silting up of the harbour of the mother city of Kayal by sand brought down by the river Tambrapurni.

In recognition of the chief townsman's enterprise in transferring his town to the coast and thus conserving to the Nayak a sea-port able to rival the Tuticorin of the Portuguese, several gifts were made to the headman, the chief being the grant of ten "free" divers' stones at the fishery. In return he was with "seven large boats, with 96½ stones, at 13¾ stones to each boat, to fish the pearl banks for the use and benefit of the said Government" (of Madura). It is expressly said, "he is to reside near the Government House of the Portuguese at the sea-port of Mannar and near Marie Amman's chapel at Tuticorin. *He shall have* the superintendency of the pearl fishery and shall receive 60 chacrums per month and shall be favoured with ten stones to dive for him at the said two places" (Mannar and Tuticorin).

The 96½ stones above mentioned represent the allowance conceded by the Portuguese to the Nayak *in return for the privileges before named.* Later we shall see that the question of the consideration given in return for this privilege became the source of continual disputes between the Dutch and the Nawab of the Carnatic, the latter succeeding by conquest to the rights of the Madura Nayaks in the early part of the eighteenth century.

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* Moormen is tho appellation used in Ceylon, whereas Lubbais or Lebbes is more commonly used on the Indian Coast for the same people.

† Termed "Choliars" in this grant. In the tenth century the Chola dynasty overthrew the neighbouring sister kingdoms of the Chera and Pandya, and reigned paramount from the vicinity of Madras to Cape Comorin.

It was doubtless subsequent to this period that the Tamil Muhammadans of South India became known as the *Choliya Muhammadans* or more commonly *Choliyar* or people of the Tamil country called *Chola-desam.* To this day the Hindustani Muhammadan speaks of his southern co-religionist as Choliya; for, save as to religion the vast majority of the Choliyar are Tamils in point of language, general appearance and social customs—*vide* Ramanathan "The Ethnology of the Moors of Ceylon" in Journal R.A.S. (Ceylon Branch), Volume XIII, page 245.

Other free stones * were at intervals during the sixteenth century granted out of these 96½ privilege stones by the Nayak to various temples from religious motives, as in 1542 and 1546.

Besides the Nayak of Madura, the Portuguese allowed to his tributary the Setupati Raja of Ramnad † a further number of free divers (60 stones) in each fishery in return for the help he gave in contributing to the success of the fishery and in guarding and providing pilots for the passage of the narrow strait called Pámban pass, separating the mainland from the Island of Rameswaram.

This petty sovereign, who is the hereditary guardian of the temple of Rameswaram and is the head of the Marawar caste, was commonly known as the Katta Theuver or Tuever in the days of the Portuguese and the Dutch. While nominally under the Madura monarch, the Setupati was virtually independent and leaned more to the foreigners, for his lands being coastal and insular, danger was greater from the sea than from the land. His territory included the coast as far south as Kilakarai, the great Moor diving centre at the present day, and for that reason his assistance had to be courted and purchased by the European lords of the pearl fisheries.

Like him of Madura, the Ramnad lord granted some of his privilege divers to the great Hindu temples of his district, giving seven stones to Rameswaram pagoda in 1609 and three more in 1714.

Besides the 60 free stones, the Setupati had the right by custom under the Portuguese to one day's fishing from all his subjects, as had the Nayak from his.

Taken generally the fisheries under the Portuguese appear to have been of great collective profit during the first half of the period of their rule, a period coincident with the height of Portuguese energy and power, when they had no European rivals and when they were free to concentrate their forces entirely against the native races. After breaking the power of the Arabs, the Portuguese enjoyed all the advantages conferred on the nation possessing the mastery of the sea, a consideration of supreme importance in connection with such an essentially maritime industry as the pearl fishery.

Encroachments and claims on the part of the Nayak of Madura were then as common and as troublesome as those experienced in the eighteenth century by the Dutch in their relations with the Nawab of the Carnatic. The methods adopted by the Portuguese to cope with these infringements of treaty rights and to afford protection to their subjects and allies, the Parawas, appear to have been most radical and effective, consisting in the removal of all Christian natives from the Madura coast to Mannar and to the string of islands skirting the coast from Tuticorin to Pámban with a concurrent blockade of the Nayak's seaboard. Nor was the blockade a peaceful one as we learn from Van Reede and Laurens Pyl's Memoir of 1669 quoted above. To use their words "the Portuguese with their boats pillaged the entire sea-coast, which they

* By "stones", divers are to be understood, a diving stone being the indespensable item in a diver's equipment. Each stone is, however, usually shared by two divers, so it is probable that the 96½ stones here referred to represented an allowance of 193 divers.

† The rulers of Ramnad have had many titles indicating an ancient and illustrious past. To-day their lands form a zemindari and from the date of Talikota (1565) they constituted one of that peculiar class of petty Hindu Sovereigns who held their lands tributary to larger States, usually Muhammadan, and to whom belong rightfully the title of zemindar. As usually employed now in India as a designation of any large landed proprietor the term is used in an altered and corrupt sense.

The title by which the Chief of Ramnad is now known is that of Raja; in former days Setupati or Sethupathi and Katta Theuver were titles more particularly distinctive and peculiar to these petty rulers.

The Raja of Ramnad is the hereditary chief of the warrior caste of Marawas, of whom the honorific and generic caste name is Thevar or Tevar and from this was derived the title Katta or Catta Theuver or Teuver by which the Dutch refer to the Sovereign of Ramnad in all their documents.

The Rajas of Ramnad have ever been intimately connected with the great Hindu temple of Rameswaram; they are the hereditary guardians of the temple and held possession till 1767 of the narrow channel between Rameswaram and the mainland known as Pâmban Pass. The remains of a broad and well-built causeway stretch from the Indian shore across the "pass" and onwards from Pâmban over the eight miles of sandy ground that remain to be traversed ere pilgrims reach the shrine of Rama. Originally the causeway was continuous from shore to shore, a causeway invaluable to the millions of pilgrims resorting to the temple and the source of much importance to the sovereign of the district, who possibly derived his most ancient title from this fact—"*Setupati*" or "Lord of the Causeway" (Sethu or Setu, a causeway and Pati, a lord) though as Adam's Bridge, the bank connecting the islands of Rameswarem and Mannar, is known specifically as "the causeway" (Setu) among Tamils, we may also read the title as signifying "Lord of Adam's Bridge".

At the height of their power the Setupatis owned much of the low country between Ramnad and Madura, together with the island of Rameswarem, and Setupati coins exist dating from this period. The growing power of the Nayaks of Madura circumscribed their limits in the sixteenth century and thereafter they existed chiefly by the aid afforded by an alliance first with the Portuguese and later with the Dutch.

disquieted so effectually that the renters and overseers (of the Nayak) on account of the great loss they suffered in their revenues were obliged to request the Nayak to call the Portuguese back again."

During this period of disturbance the Parawas held pearl fisheries from the small islands along the Madura coast and "assisted to the best of their power the Portuguese vessels."*

I refer to this period of the temporary settlement of the Parawas in the Madura islands, the unmistakable evidence of a fishery camp to be seen to-day among the sand-dunes of Nallatanni tivu, an island lying off the coast between Kilakarai and Tuticorin. If we fix the date of this fishery at 1560 to 1570 we cannot be far out, for, it was in 1560 that the Viceroy Don Constantine de Braganca erected the fort of Mannar and transferred thereto the inhabitants of the Parawa town of Pinnacoil, the scene of Francis Xavier's labours twenty years previously, and one of their chief and most prosperous settlements. †

By this change the island of Mannar become rich and prosperous as long as the fisheries continued to give handsome returns. De Sa e Menezes (*loc. cit.*) writing in 1622 states that for many years the fisheries had become extinct "because of the great poverty into which the Parawas had fallen, for they made no profit for want of accommodation and of boats"—a result likely to arise from the exactions of Church and of State, from the natural improvidence of the race and from the rapid decay of Portuguese sea-power consequent upon the successful inroads made upon their monopoly of sea-borne commerce between India and Europe. The Portuguese, struggling for very existence and in continual straits for the money requisite to carry on an exhausting contest, increased their exactions from the natives and at the same time were unable to give them adequate protection, especially at sea. We may infer with every probability of this being true, that from the time the Dutch first appeared in force in Indian seas, a time coinciding with a period of great official corruption and internal unrest among the Portuguese, the management of the pearl banks became inefficient and badly conducted.

Tuticorin and the sovereignty of the pearl banks and of the Parawas passed to the Dutch in 1658. In 1663 the first fishery under the new rule was held, resulting in a profit of 18,000 florins. ‡

At this fishery the Nayak of Madura and the Setupati of Ramnad and the head Moor of Kayalpattanam had their accustomed number of boats free as under the Portuguese.

Just prior to this fishery Cornelis Valkenburg had written "The fishery of Mannar (Gulf of Mannar) is in great repute with the Portuguese and everybody else, but if it be really of much importance has not yet been experienced and therefore I can give no information on the subject". §

The second Dutch fishery took place six years later, in 1669, with what profit I do not know. Then a long interval of 22 years occurred bringing us to the third fishery, 1691, at which there were $385\frac{1}{2}$ stones admitted free, viz.:—

$96\frac{1}{2}$ for the Nayak of Madura.

59 for the Setupati of Ramnad and the remainder for the headmen of the divers divided on the lines detailed in the statement of these arrangements at the Ceylon fishery of 1694 appended.

Six years later, 1697, we find Croon, the Commandant of Jaffna, writing that "the pearl fishery is an extraordinary source of revenue, on which no certain reliance can be placed, as it depends on various contingencies which may ruin the banks or spoil the oysters. If no particular accident happen, it may take place for several

* Van Reede and Pyl *loc. cit.*

† De Sa e Menezes describes Pinnacoil (Putioale as he spells the name—probably a misprint) at the time of this transference as "a place on the Fishery Coast, inhabited by Parawas, who tired of the continual attacks of the Bodaguas, their neighbours, lived more the life of fronteros than of fishermen, which trade they plied for subsistence, but were continually robbed and cut off by their neighbours." "The Rebellion of Ceylon," translated from the Spanish by Lieutenant-Colonel H. H. St. George.)

‡ See Appendix A, page 85.

§ In instructions left for the guidance of his successors, the Residents of the seven Harbours on the Madura Coast, "Ceylon Lit. Reg.", Vol. III, page 160.

years successively . . . . but if the oysters happen to be washed off the banks or to be disturbed by storms, the banks may be totally ruined in a very short time. . . . . The examination . . . . is superintended by Commissioners specially appointed and is conducted in . . dhonies by Pattangattyns and other native headmen, who understand the business ".*

The next glimpse we get of a fishery off the Tuticorin coast is in the graphic description by Father Martin, a Jesuit missionary, of a disastrous three days' fishery held in 1700. The description in spite of errors in detail is so vivid and instructive that it may well be reproduced here for comparison with that left on record by Ribeyro of the methods pursued in Portuguese days and also with those employed at the present time.

" In the early part of the year the Dutch sent out ten or twelve vessels in " different directions to test the localities in which it appeared desirable that the fishery " of the year should be carried on; and from each vessel a few divers were let down " who brought up each a few thousand oysters, which were heaped upon the shore in " separate heaps of a thousand each, opened and examined. If the pearls found in each " heap were found by the appraisers to be worth an *ecu* or more, the beds from which " the oysters were taken were held to be capable of yielding a rich harvest; if they were " worth no more than thirty sous, the beds were considered unlikely to yield a profit " over and above the expense of working them. As soon as the testing was completed, " it was publicly announced either that there would, or that there would not, be a fishery " that year. In the former case enormous crowds of people assembled on the coast on the " day appointed for the commencement of the fishery; traders came there with wares of " all kinds; the roadstead was crowded with shipping, drums were beaten, and muskets " fired; and everywhere the greatest excitement prevailed, until the Dutch Commis- " sioners arrived from Colombo with great pomp, and ordered the proceedings to be opened " with a salute of cannon. Immediately afterwards the fishing vessels all weighed " anchor and stood out to sea, preceded by two large Dutch sloops, which in due time " drew off to the right and left and marked the limits of the fishery, and when each " vessel reached its place, half of its complement of divers plunged into the sea, each " with a heavy stone tied (*sic*) to his feet to make him sink rapidly,† and furnished with " a sack into which he put his oysters, and having a rope tied round his body, the end " of which was passed round a pulley and held by some of the boatmen. Thus equip- " ped, the diver plunged in, and on reaching the bottom, filled his sack with oysters " until his breath failed, when he pulled a string with which he was provided, and, the " signal being perceived by the boatmen above, he was forthwith hauled up by the " rope, together with his sack of oysters. No artificial appliances of any kind were " used to enable the men to stay under water for long periods; they were accustomed " to the work almost from infancy, and consequently did it easily and well. Some " were more skilful and lasting than others, and it was usual to pay them in proportion " to their powers, a practice which led to much emulation and occasionally to fatal " results.

" As soon as all the first set of divers had come up, and their takings had been " examined and thrown into the hold, the second set went down. After an interval, " the first set dived again, and after them the second; and so on turn by turn. The " work was very exhausting, and the strongest could not dive oftener than seven or " eight times in a day, so that the day's diving was finished always before noon.

" The diving over, the vessels returned to the coast and discharged their cargoes; " and the oysters were all thrown into a kind of park, and left for two or three days, " at the end of which they opened and disclosed their treasures. The pearls, having " been extracted from the shells, and carefully washed, were placed in a metal receptacle " containing some five or six colanders of graduated sizes, which were fitted one into " another so as to leave a space between the bottoms of every two, and were pierced " with holes of varying sizes, that which had the largest holes being the topmost " colander, and that which had the smallest being the undermost. When dropped into

* Lee's translation of Ribeyro's " History of Ceylon," page 247.

† The writer is obviously in error when he states that the diving stone is " tied " to the diver's foot, that a diver cannot dive oftener than seven or eight times a day and also in his account of the method of extracting the pearls from the decaying oysters.

His statement that one day's catch (not necessarily the first) belongs expressly to the King (Nayak of Madura) or Setupati according to the locality where the fishery takes place is correct only with regard to India. This privilege was frequently contended for by the Nawab of the Carnatic at the Aripu fisheries but was consistently refused by the Dutch, who however allowed the exaction to be made by mutual agreement between this potentate and those of his subjects taking part in the fisheries held on the Ceylon side, the suzerain right to one day's fishing (Valy or Wally) being reserved at Aripu by the Dutch Government as one of its sources of revenue.

"colander No. 1, all but the very finest pearls fell through into No. 2, and most of them "passed into Nos. 3, 4 and 5; whilst the smallest of all, the seeds were strained off "into the receptacle at the bottom. When all had staid in their proper colanders, they "were classified and valued accordingly. The largest, or those of the first class, were "the most valuable, and it is expressly stated in the letter from which this informa-"tion is extracted that the value of any given pearl was appraised almost exclusively "with reference to its size, and was held to be affected but little by its shape and "lustre. The valuation over, the Dutch generally bought the finest pearls. They "considered that they had a right of pre-emption. At the same time they did not "compel individuals to sell, if unwilling. All the pearls taken on the first day "belonged by express reservation to the King or to the Setupati according as the "place of their taking lay off the coasts of the one or the other. The Dutch did not as "was often asserted, claim the pearls taken on the second day. They had other and "more certain modes of making profit, of which the very best was to bring plenty of "cash into a market where cash was not very plentiful, and so enable themselves to "purchase at very easy prices. The amount of oysters found in different years varied "infinitely. Some years the divers had only to pick up as fast as they were able, "and as long as they could keep under water; in others they could only find a few "here and there. In 1700 the testing was most encouraging, and an unusually large "number of boat-owners took out licenses to fish; but the season proved most dis-"astrous. Only a few thousands were taken on the first day by all the divers together, "and a day or two afterwards not a single oyster could be found. It was supposed "by many that strong under-currents had suddenly set in owing to some unknown "cause. Whatever the cause the results of the failure were most ruinous. Several "merchants had advanced large sums of money to the boat-owners on speculation, "which were, of course, lost. The boat-owners had in like manner advanced money "to the divers and others, and they also lost their money." *

The fishery of 1708 appears the next that was held, and one that gave a satisfactory return. At this fishery 398 free stones were allowed as follows:—

"*List of free stones according to ancient customs.*

$96\frac{1}{2}$ to the Naick of Madura—4 Xtian, $92\frac{1}{2}$ Moorish
60 to Theuver—60 Moorish.
10 to Head Moorman of Cailpatnam—5 Xtian, 5 Moorish.
185 to the Pattangatyns of this coast—all Xtian stones.
30 to those of Mannar.
13 to those of Jaffnapatam.
$3\frac{1}{2}$ lost by 4 Moors who died in the fishery.

398 Stones free, valued at Pards (Pardãos) . . . . 3,591."

The 185 stones given to the Pattangatyns or headmen of the Parawas was in the nature of remuneration to these men for assistance in inspecting the banks, in guarding any oyster banks discovered, in recruiting divers and in superintending operations during the course of the fishery. All these stones are specifically termed "Christian stones", meaning that the divers using them were Christians (Parawas), whereas those allowed to the Nayak and Teuver (Setupati of Ramnad) were all Moorish, save for four Christians. The explanation of this division is that the two great Muhammadan settlements, Kayalpattanam and Kilakarai were situated respectively in the territories of the Nayak and the Setupati, whereas the sovereignty over the Christian Parawas was vested expressly, first in the Portuguese and then by conquest in the Dutch.†

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* Thurston, E. "Pearl and Chank Fisheries of the Gulf of Mannar", Madras Museum Bulletin, No. 1, page 9, Madras, 1894.

† The employment of native headmen in the examination of the Pearl banks and in the management of fisheries and their remuneration by the grant of similar privileges to the above was continued by the Ceylon Government up to 1863. Latterly there were but five employed, namely the Adigar of Mannar, the Maniagar of Karaiyur, two Adapannars and a Pattankoddi. The remuneration was five stones (the equivalent of one boat) to the Adigar, two to the Maniagar and one apiece to the other headmen. Sir William Twynam (Report on the Ceylon Pearl Fisheries, 1900) states that they generally sold their privileges at the beginning of a fishery. The Adigar of Mannar had the last privilege in 1863. Regarding the quality of the assistance they rendered Sir William Twynam remarks "I found them highly intelligent and well-informed men, well acquainted with the Pearl banks and matters connected with the fisheries. They helped Mr. Vane and Captain Pritchard to carry on the fisheries in 1855, 1856, 1857, 1858, 1859 and 1860 and the Adigar of Mannar rendered me very valuable service during the fishery of 1863." With this favourable estimate I heartily coincide both in regard to the present Adigar of Musali and the present representatives of the fishing and diving communities on the Indian coast; a tactful and sympathetic attitude and the avoidance of any act or speech likely to arouse their prejudices soon win their confidence and in the present condition of the management of the Indian Bank the assistance they can render is not in any way to be despised.

The financial account of this fishery which has fortunately survived the vicissitudes of time is dated 24th May 1708 and is as follows :—

" TUTICORIN, 24*th May* 1708.

In this fishery the whole number of stones employed was	...		4,321⅓
		P'DS.	
Namely, 2,380 Xtian at 7 pardaws each of 10 fanams	...	16,660	
1,551⅓ Moorish at 12 pardaws each of 10 fanams	...	18,618	
390 Heathen at 9½ pardaws each of 10 fanams	...	3,705	
Pards.	...	38,983	
Deduct 398 free stones at above value	...	3,591	398
Pards.	...	35,392	Sts. 3,923⅓
About	...	fl.106,176	
	=	£9,000	

From this statement we learn that the total of stones employed reached the astonishingly large number of 4,321⅓, considerably more than the number of divers who attended the Ceylon Fishery of 1903, * a fishery which gave the prodigious total of 41,169,637 fished oysters and a Government gross revenue of Rs. 8,30,000.

Are we to infer that this Tuticorin Fishery of 1708 although yielding but £9,000 (Rs. 1,35,000 at the present exchange) to the Government was not so productive of oysters as the Ceylon one instanced ? In the absence of other particulars we have no means of judging with certainty but as the average price per stone is some 9 pardãos, each equal to about four guineas, and as this sum represents the license to fish accorded to a diver for the whole period of the fishery we may infer with some degree of probability from the large number of men engaged that the total catch may have been equally large. Under the conditions that rule at the present day, Government obtains a greater profit upon the fisheries, receiving two-thirds of the entire catch ; hence the receipts from the sale of the right to fish probably made the fishery much more profitable to the subject in the early days of Dutch rule and acknowledged receipts of fl106,176 (Rs. 1,35,000) would represent a fishery on a scale of magnitude comparing most favourably with the fisheries held during the last half of the 19th century.

The proportions of divers supplied from the three religions then prevalent is also shown by this account, namely—

2,380 Christians (Parawas).
1,501 Moormen.
390 " Heathen ", *i.e.*, Hindus.

These 390 Hindu divers did not represent a remnant of Parawas remaining unconverted to Roman Catholocism, but belonged to the Kadeiyar caste of lime gatherers and burners of Rameswarem and the neighbourhood from which caste the ranks of the divers are in part recruited at the present day.†

So far as I can ascertain no divers practising the Hindu religion have attended any pearl fisheries during the last half century, while the relative proportionate strength of Christians and Muhammadans has gradually tended to the preponderance of the latter, so that at recent fisheries the Muhammadans outnumber the Christians, an increase due partly to larger families reared by the latter and to the more regular and abstemious lives they lead.

In my report on the Ceylon fishery of 1904 I noted the marked superiority of Muhammadan over Christian divers in the number of seconds they remain under water and in the greater number of oysters collected per dive—a superiority that makes the work of the former more productive and valuable. This appears to have been recognised in a very practical manner in the old fisheries we are now considering, as we see

* The total of divers who attended the Ceylon Pearl Fishery of 1903, was 3,922.

† Many of this caste are now converted to Roman Catholicism, and it is from this division of the caste that the present supply of Kadeiyar divers is drawn.

from the account given above that the Moorish stones sold for 5 pardãos more than those of the Christians, the rate of market valuation being as. 12 to 7. Strangely enough the Hindu stones occupied an intermediate value, being $9\frac{1}{2}$ pardãos per stone.*

At the Ceylon fishery of 1694, a similar disparity is noticeable there being then sold :—

1,290 Christian stones at $6\frac{1}{2}$ Rixdollars.
204 Gentoo (Hindu) at 9 do.
1,268 Moorish ,, at $11\frac{1}{2}$ do.

In the accounts of this last fishery, I notice an entry of " $13\frac{3}{4}$ ammonams of concealed arrack found in the bushes and out of the way places, sold at 6 Rixdollars the ammona = $82\frac{1}{2}$ Rixdollars," from which I fear we have to infer that the Parawas were as greatly addicted to this indulgence 200 years ago as they are now !

No further fishery appears to have taken place between 1708 and the date of the relinquishment of the Governorship of Ceylon by Baron Van Imhoff in 1740.

Such a lengthy intermittence in productiveness had been a source of continual regret to his predecessors, so that when Van Imhoff wrote his valedictory memoir in 1740 for the information and guidance of his successor, he urged a departure from the policy of conducting the fishery in aumany or directly on behalf of Government. Under such conditions the Government had made its profit by the sale of the right to use diving stones at the fishery (amounting virtually to the taxation of the divers employed) and of the sundry duties levied in the fishing camp (" Exchange," Bazaar and cloths).

This memoir is perhaps the most valuable and statesmanlike administrative record left by any Dutch Governor. Therefore it is well if I give *verbatim* the portion relating to the condition of the Pearl Banks at this time and to the alternative policy of administration advocated here for the first time.

Extract from the Memoir of His Excellency G. W. Baron Van Imhoff on his departure from the Government of Ceylon, left for the instruction of his successor, His Excellency William Maurits Bruyninl.

" The Aripo and Tutucoryn Pearl Fisheries are certainly to be reckoned among " the sources of produce to this island or rather of revenue for the profit which the " Company derives from the holding of a fishery must rather be classed under the latter " head than under the former, as it consists in different duties which are paid for diving " those banks, and divers sums paid for the stones used in catching the oysters, and " some part in oysters themselves paid as taxes, which are sold when the fishery is at " an end ; duties are also paid on what is called the exchange, and on cloths which are " brought to the bazaar, but the Company does not in fact obtain any pearls, nor is " there even a chance for the Company to purchase any pearls there, although the " highest authorities have so often endeavoured to do so, for at the fishery pearls are " sold at so high a price that the Moors are cunning enough to rub up even old pearls " and to bring them there for sale, with a certainty of taking in the unwary, and " deriving more profit from it.

" But it is not so much a matter of concern whether the fishery is to be called a " source of revenue or of produce, as whether it can in reality be looked upon as a " source of advantage and profit derived from Ceylon, or whether it is more glitter than " gold, as many things are which belong to the Company, which shine uncommonly, " but have no real substance. This question is neither a novel nor unfounded one, " and to properly answer it, we must weigh against the advantages which we have just " detailed, the inconveniences, discomforts, noise, expenses, the risks of the Commission- " ers, the employment of the Militia, the consumption of provisions, the dangers of " ships, etc.; we must also mention the hazards run by a few hundred men sent to keep " immense crowds in order, and their exposure to sickness and death as well after the " fishery as during its continuance from the stench of the oysters ; the price of provi- " sions is also enormously increased ; the Company's trade in cloth is discontinued for " a long time from the prevalence of smuggling which is occasioned by the immense " numbers of persons resorting to those parts of the island ; we may also add that

* *Ante.*

" pepper is smuggled away, as well as arecanuts, although it would be thought that " a multitude of more than 100,000 persons who consume these nuts for the space of " two or three months should give some profit, yet the Company draws nothing from " it. If therefore all these matters be weighed, one against the other, it must be " decided, as I, for my part, maintain, that unless the fishery be indeed a full and " opulent one, all others must be prejudicial to the Company's interests; and it were " really desirable that no such fisheries should take place, but that there should be " an annual rent for the diving of the banks, as now takes place with regard to the " chanks, with a limited number of persons and of boats; or in some other convenient " way that a mode should be devised to acquire for the Company the profit which " they should derive from the fisheries, both here and on the opposite coast, as Lords " of the country, without the holding of any public fishery. The bad condition of " the pearl-banks on both sides the coast has lasted for some years, and there is now " no prospect of an early fishery; yet this cannot be attributed to any disorder in the " country any more than the want of purchasers for our Madura cloths. This is mere " chance and experience has shown that the banks have lain fallow for a much longer " time than has as yet been the case on this occasion, and it is useless therefore to " seek for the causes of things which are neither uncommon nor unheard of. I only " mention this cursorily, and to prove that the interest of the Company requires that " an examination of the banks should take place every two years, if not every year, " which indeed is not absolutely necessary, and the expense may therefore be spared; " yet from time to time or say every two years, an investigation should take place.

" As far as the inspection of the Aripo banks is concerned, Tutucoryn boats should " be employed, as their Honors recommended in a recent despatch, a Dissave from " Jaffnapatam should also be present to see that no neglect takes place, and to summon " the boats from the opposite coast, and to take all necessary precautions when appear- " ances prove favourable, in order to ensure a good result; for the Company has been " shamefully treated in this respect since the fishery of 1732. Indeed there are many " natives who pretend to give reasons for the failure of the banks, and who say that " the multitude of persons forced there against their will have ruined the banks, whilst " others looked to their own profit too much, and also that the divers have not spared " the young oysters, and that this accounts for the nakedness of the banks which have " not yet recovered from their last pillaging. All this is as probable as the pretexts of " the country being under a spell, but to end this matter we will pray God that the " Island may never again suffer losses such as it now sustains from one cause or the " other."

Four years after the date of this memoir, namely in 1744, Baron Van Imhoff became Governor-General of the Netherlands Indies and immediately called attention to his Ceylon memoir. He desired to be informed whether it would not be advisable to discontinue the open fisheries and preferable to rent them out to a single individual. Van Gollenesse, the new Governor of Ceylon, in a closely-reasoned reply, * meets and refutes the objections likely to be raised to this change and strongly advocates an alteration in the method of conducting the fisheries, which was thereupon sanctioned.

Accordingly the fishery which took place in 1746 was conducted on this new footing: all free boats and stones were abolished, for, as the Governor states, these privileges were merely conceded to the Nayak and the Setupati because the greater number of the dhonies and people required at a public fishery came out of their territory, and these would not be necessary if the diving took place with a limited number of persons. All privileges were therefore withdrawn and the following instructions were given to the Commissioners of the Pearl Fishery by Governor Van Gollenesse:—

" If it should happen (which is however improbable) that the Nabob or Theuver " should send their Ambassadors to be present at this Fishery, and to take care of " their pretended rights, they are not to be allowed to land, but some armed boats well " filled with men and ammunition must be sent to meet them, and they must first be " warned in a friendly way to depart, and if this be ineffectual, the matter must be " treated more seriously, and you must order the Commanders of our boats that they

* See Appendix D, pages 90–92.

"are by no means to permit any armed foreign boats of a suspicious kind to come "within range of their shot, and if warning given does not turn them away, they must "fire on them at once."

1747. This year the unproductive cycle that had prevailed so long on the Tuticorin side was broken, the fishery being *rented out* for 60,000 florins (£5,000).

The change of system now introduced involved the abolition of the privilege of free or untaxed divers hitherto granted to the native rulers of Madura and Ramnad, whose dominions had now merged in those of the Nawab of the Carnatic who had dispossessed the last of the Nayak dynasty of Madura in 1736. He, a more powerful ruler than the Nayak, did not acquiesce without stout opposition and at the 1747 fishery it had been thought wise to permit the renter of the fishery to give 30 free divers to the Nawab for which concession the renter received a proportionate reduction in the stipulated price of his rent.

Two other fisheries, also rented out, took place in the two next succeeding years. The rental of that of 1748 amounted to 114,720 florins (£9,560), while that of 1749 was florins 63,600 (£5,300).

At the former, 35 free divers were again allowed to the Carnatic overlord, much against the Dutch Company's will however, for we read in the secret instructions sent to the "Company's Commissioners in the rented fishery on the coast of Madura" before the fishery of 1749:—

"We think it necessary to inform you also that as the Armane may cause much "injury to our defenceless Linen Factories, we granted the Nabob, on his urgent "request, 35 divers in the two last fisheries, but Their Excellencies (the Government of "Batavia) did not approve of this concession, and therefore, in case His Envoys should "again claim this grant from you, you must endeavour to reduce the number to 17 or "18 divers, showing that even this will give greater profit than the 96½ which the "Nabob had formerly in an open fishery, when the whole number of stones amounted "to several thousands.

"But if you cannot effect this, and if you see any risk for the Company's becom-"ing embroiled with the Regent by a pertinacious refusal, you will then be empowered "to grant 30 or 35 divers, but it must appear to be done without our knowledge, and "on your own private authority.

"But if the Catta Theuver, or any other native chief, should request a similar "concession, you must refuse it flatly."

Between 1749 and 1784 I can trace no record of any further Pearl fishery off the Tuticorin coast save the suggestion of one in 1771 furnished by the existence of a set of "Conditions of a rent of the Tutucoreen Fishery of 1771". Article XXX of these conditions reads—

"Lastly the renter of the fishery must admit 20 dhonies of the Armanie or "Regent of Madura, with 96½ stones and two dhonies on the part of the Catte "Theuvers *, manned in the same manner as the Renter's dhonies, which 22 dhonies, "together with 180 of the renters, shall fish throughout the whole fishery without "the renters being permitted to make any demand on that account."

Of the fishery of 1784, the only particulars I have (furnished by the Madras Government) are that it was held on the Tolayiram Par, giving to the Company, which fished it departmentally, a gross revenue of 20,000 eully chuerums. This at Rs. 2–1–11½ per eully chuerum gives a return in rupees of Rs. 42,447–14–8.

This long series of blank years extending, with the doubtful exception above mentioned, over a period of thirty-five years, may have been due up to 1768 to imperfect inspection or to natural causes or to a combination of the two, but the intermittence thereafter arose in the main from the reluctance of the Dutch to agree to the pressing demands of the Nawab of the Carnatic to participate upon exorbitant conditions in the profits arising from the fisheries both on the Ceylon and the

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* The Catte Theuvers, the Setupati Rajas of Ramnad, made a treaty with the Dutch in 1767, whereby in exchange for the possession of Pamban Pass and the surrender to the Dutch of the right to levy dues on shipping passing there—through, the Dutch agreed to grant the Setupati two free diving boats at all the future pearl fisheries held on the banks lying off the coast of Madura, or "under the territory of Tutucoryn together with the privilege *to purchase* from the Dutch Government in every fishery held on the Ceylon side five boats at the same price as the renter should contract."

Indian Banks. As already mentioned, at the Ceylon Fishery held at Aripu in 1768 violent disputes occurred with the Nawab's envoys who went to the fishery attended by a large body of armed sepoys and tried to carry matters with a high hand.

The Dutch loth, with their usual caution and fear for the interruption of their cloth monopoly in Madura, to bring matters to a crisis, preferred to let the pearl fisheries remain virtually in abeyance till a settlement was effected on equitable terms—terms which meant the curtailment if possible of the Nawab's pretensions.

It was not till 1786 that the Dutch, pressed by the English Government in Madras (to whom the Nawab had appealed as his ally and virtual suzerain) to effect a settlement of the long-standing dispute, made provisional terms with the Nawab.* By these the Nawab obtained much greater advantage than had been contemplated twenty years previously, due to the dwindling power of the Dutch and their growing fear of the rapid extension of the military power and commercial supremacy of the English East India Company.

The chief articles of the agreement affecting the Pearl fisheries were that the Nawab should be granted one-half of the profits arising from fisheries off the Madura coast and have 36 free dhonies at any fisheries held on the Ceylon side, privileges allowed in return for a confirmation of the Dutch trading monopoly in Madura cloth—ever one of the most lucrative sources of revenue to the Dutch Company.

The treaty, however, was never fully ratified, but by the advice of the English Governor of Madras its terms were allowed to govern the fisheries of 1787 and 1792, the profits therefrom being accordingly shared equally by the Circar or Government of the Carnatic (*i.e.*, the Nawab) and the Dutch Company.

The fishery of 1787 took place on the Tolayiram Pár and gave a gross revenue of Rs. 63,000: that of 1792 upon the Uti, Uduruvi, Kilati and Attuveiarpagom Párs, which lie inshore of Tolayiram Pár; it yielded Rs. 42,525 to the joint Governments.

Except with regard to the conduct of these two fisheries, the treaty never came into force, the Madras Government steadily refusing its consent because of the objectionable clause relating to the cloth monopoly. In this unsettled condition, marked by the continual interchange of despatches between Colombo and Madras, matters remained till the Dutch dominion of the Pearl Banks on both sides passed to the British in 1796.

The Pearl Banks under the British.

Not long after the acquisition of the Pearl Banks by the British, the districts bordering the coast in this region and now known as that of Tinnevelly in the south and Madura in the north, passed to the British from the Carnatic Nawab. Thus the "Lords of the Pearl Fishery" acquired sovereign rights over the districts supplying the whole body of divers and by their own power could ensure safe conducts from Madura, Ramnad, Bombay, and Madras to the dealers in pearls whose attendance is necessary to the success of any fishery. The dues levied for assistance by local potentates, the source of constant anxiety and loss to the Portuguese and the Dutch, were brought to an end and for the last half century we hear of no privileges allowed save a few on a reduced scale to the headman of the Parawas. It is noteworthy to observe that this system of remuneration by fishery privileges of which the last remaining trace was abrogated in Ceylon in 1863, still lingers in the management of the Indian banks, the headman of the Parawas having the right to employ a limited and specified number of "free" boats at each fishery in return for help rendered during the inspection of the banks and at the fisheries when held.

This hereditary chief or Jati Talaivan † of the Parawas, like many of the descendants of natives of Ceylon who gave assistance to the Portuguese, bears the honorific prefix of "Don", while the name of the present holder of the Chieftainship—Gabriel de Cruz Lazarus Motha Vas—further indicates the intimacy of his family's connection with Portuguese rule.

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* Two years later a definite treaty on the same lines was signed by the Dutch.

† Literally "Head of the Caste". His full title is Jati Talaivamore—the suffix "more" being, I believe, honorific.

His duties consist in accompanying the Inspector on his periodical visits to the banks—a duty formerly performed directly by the headmen themselves,—in furnishing guards to the banks to be fished, in supplying Government with information of any accidental finds of oysters by fishermen and in acting as intermediary between the Government and his caste with a view, by the exercise of his influence, to ensure the attendance at a fishery of an adequate supply of boats and divers.

In 1889 the Madras Government recorded its appreciation of the assistance rendered by the Jati Talaivan and "directed that his privilege of being allowed the take of two boats be continued".* Each boat is understood to carry 10 divers.

Subsequently, in 1891, the Madras Government while confirming the general principle of privilege remuneration to the headman named, adopted the more satisfactory regulation of placing the extent of the remuneration upon the basis of a sliding scale, allowing him but one boat when the Government boats numbered 30 or less, two for 31 to 60 boats, three for 61 to 90 boats employed and so on in this ratio.

The value of the Jati Talaivan's two privilege boats in the 1890 fishery was Rs. 1,424, in that of 1900 only Rs. 872.

During the 100 years ending 1900 there appear to have been the following twelve fisheries.

* Proceedings of the Board of Revenue, Madras, No. 702, 1889. The amount which this privilege realized to the headman at the 1889 fishery was Rs. 7,620.

Year.	Number of working days.	Number of boat fishings.	Average number of boats fishing per day.	Total number of oysters lifted on Government account.	Grand total of oysters fished.	Age of oysters.	Gross Government revenue.	Net Government revenue.	Average price per 1,000.	Locality.	Authority.
1	2	3	4	5	6	7	8	9	10	11	12
							RS.	RS.	RS. A. P.		
1805	..	..	..	....	..	..	39,109	..	..	Velangu Karuwal Pár ..	From particulars furnished by the Madras Government, supplemented in the cases of the 1805—1815 Fisheries by the Jati Talaivan's records.
1807	..	..	..	....	71,647,305	..	2,91,539	..	..	Tolayiram Pár	
1810	..	..	..	22,036,658 plus oysters fished by Government departmentally.	..	..	2,38,897	..	..	Do.	
1815	..	..	..	....	..	..	Nil (an unsuccessful fishery).	..	..	Velangu Karuwal, Karai Karuwal and Tiruchendúr Puntotta Párs.	
1818	..	..	..	....	More than 15,500,000	..	1,67,708	..	..	Kudamuttu, Saith Kudamuttu, and Putu Párs.	
1822	..	..	..	....	..	..	1,55,693	..	..	Tolayiram Pár	
1828	..	..	..	....	7,541,940	..	70,127	..	..	Kudamuttu, Saith Kudamuttu, Putu, Kadian, Kanavai and Rajavukku Sippi Sotichcha Párs.	
1830	..	..	..	....	12,858,993	..	1,01,639	..	..	Tolayiram, Uti, Uduruvi, Kilati and Padutta Marikan Tundu Párs.	
1860-61	..	..	..	....	..	..	2,50,276	2,21,861	..	Cruxian, Cruxian Tundu, Nagara, Uti, Uduruvi, Atonpatu, Kilati, Devi, Pernandu and Vaipar Karai Párs.	Proceedings, Board of Revenue, 1889, No. 484.
1862	..	..	..	....	..	..	1,29,003	1,10,619	..	Karai Karuwal and Velangu Karuwal Párs.	
1889	52	1731	33	8,423,925	12,600,531	5 years.	1,89,984	1,58,483	22 8 6	Tolayiram Par	Proceedings, Board of Revenue, 1900, No. 208.
1890	40	867	22	1,204,816	1,806,762	6 ,,	25,061	7,803	20 10 0	Do.	
1900	15	746	50	1,873,426	2,810,136	about 4 years.	19,461	11,033	10 4 9	Teradi Puli Piditta and Tundu Párs.	

The oysters are at the present day fished on Government account and according to the arrangements in force at the last three fisheries the Government claims two-thirds of the total catch, selling its share at auction. The remaining third is the remuneration allowed to the divers and boat owners.

In the following table I list and contrast all the fisheries of which I can find record on the Tuticorin and Ceylon sides, respectively, of the Gulf of Mannar:—

Particulars of Pearl Fisheries from 1658 *to* 1904.

Off Madura coast.			Off Ceylon coast.		
Year of fishery.	Government proceeds.	Remarks.	Year of fishery.	Government proceeds.	Remarks.
				£ s. d.	
1663	Fl. 18,000 ..	....	..	....	....
..	....	....	1666	4,913 15 11	Fished on Government account giving net profit as shown.
..	....	....	1667	6,160 7 5	Do.
1669	....	I can find no particulars of profits realized.	..	....	
1691	....		..	....	
..	....	....	1694	5,264 16 1	Do.
..	....	....	1695	6,177 3 9	Do.
..	....	....	1696	6,331 18 4	Do.
..	....	....	1697	6,453 0 0	Do.
1700	Very meagre ..	A disastrous 3-days' fishery.	..	....	
1708	£9,600	= Fl. 1,06,176 gross proceeds.	1708	8,848 0 0	Do.
..	....	....	1732	Not ascertainable.	An unproductive fishery.
..	....	....	1746	4,766 13 4*	Fishery rented out to adventurers.
1747	£5,000	= Fl. 60,000 (*Fide* Governor Schreuder's Memoir of 1762, as given in Lee's edition of Ribeyro's "Ceylon.")	1747	21,400 0 0	Do.
1748	£9,560	= Fl. 1,14,720	1748	38,580 0 0	Do.
1749	£5,300	= Fl. 63,600	1749	68,375 0 0	Do.
..	....	....	1750	5,940 0 0	Fishery of 6 days only.
..	....	....	1753	6,360 0 0	Fishery rented out.
..	....	....	1754	1,469 0 0	Do.
..	....	No fisheries held between 1768 and 1784 owing to disputes with the Nawab of the Carnatic.	1768	Not ascertainable.	Very unsuccessful on account of bad weather.
1784	RS. 42,477 Gross	= 20,000 oully chucrums. Fished departmentally.	..	....	....
1787	63,000 ,,	Rent received in equal shares by the Dutch and the Nawab of the Carnatic.	..	....	....
1792	42,525 ,,		..	....	....
..	....	....	1796	37,096 15 0	Fishery rented out.
..	....	....	1797	123,982 10 0	Do.
..	....	....	1798	142,780 10 0	Do.
..	....	....	1799	23,319 7 6	Net proceeds—fished on Government account.
..	....	....	1801	RS. 1,50,227	Gross proceeds—fished on Government account.
..	....	....	1803	1,63,154	Do.
..	....	....	1804	7,20,202	Gross proceeds.
1805	39,109	Gross proceeds	..	....	....
..	....	....	1806	4,12,842	Gross proceeds.
1807	2,91,539	Gross proceeds	..	....	....
..	....	....	1808	8,42,577	Gross proceeds.
1810	2,38,897	Gross proceeds	1809	2,72,463	Do.
..	....	....	1814	10,51,876	Do.
1815	*Nil.*	An unsuccessful fishery, giving no revenue.	1815	5,842	Do.
..	....	....	1816	9,266	Do.
1818	1,69,708	....	..	....	....
..	....	....	1820	30,410	Gross proceeds.
1822	1,55,693	Gross proceeds	..	....	....
1828	70,127	Do.	1828	3,05,234	Gross proceeds.

* According to Schreuder; £12,000 according to Lee (Ribeyro).

Particulars of Pearl Fisheries from 1658 *to* 1904—cont.

Off Madura Coast.			Off Ceylon Coast.		
Year of fishery.	Government proceeds.	Remarks.	Year of fishery.	Government proceeds.	Remarks.
	RS.			RS.	
..	....	...	1829	3,82,737	Gross proceeds.
1830	1,01,639	Gross proceeds	1830	2,22 564	Do.
..	....	....	1831	2,93,366	Do.
..	....	....	1832	45,810	Do.
..	....	....	1833	3,20,896	Do.
..	....	....	1835	4,03,460	Do.
..	....	....	1836	2,54,935	Do.
..	....	....	1837	1,06,312	Do.
..	....	....	1855	1,09,220	Do.
..	....	....	1857	2,03,633	Do.
..	....	....	1858	2,41,200	Do.
..	....	....	1859	4,82,159	Do.
1860	2,50,276	Gross proceeds ..	1860	3,66,816	Do.
1861			..	....	....
1862	1,29,003	Do.	..	....	....
..	....	....	1863	5,10,178	Gross proceeds.
..	....	....	1874	1,01,199	Do.
..	....	....	1877	1,89,011	Do.
..	....	....	1879	95,694	Do.
..	....	....	1880	2,00,152	Do.
..	....	....	1881	5,99,533	Do.
..	....	....	1884	17,153	Do.
..	....	....	1887	3,96,094	Do.
..	....	....	1888	8,04,247	Do.
1889	1,89,984	Gross proceeds	1889	4,98,377	Do.
1890	25,061	Do.	1890	3,13,177	Do.
..	....	....	1891	9,63,748	Do.
1900	19,461	Gross proceeds	..	....	....
..	....	....	1903	8,29,348	Gross proceeds.
..	....	....	1904	10,65,752	Do.

Twenty-four fisheries within 246 years. Fifty-eight fisheries within 246 years.

Note.—The particulars regarding the Ceylon fisheries prior to 1801 are taken from the appendix to Lee's translation of Ribeyro's "History of Ceylon," Colombo, 1847. The later figures are from official returns furnished to me by the Government of Ceylon.

The list of fisheries held on the Ceylon side is, I believe, exhaustive; possibly two or three may be omitted from the enumeration of those upon the Indian coast. As it stands we have a total of twenty-four fisheries recorded from the latter locality as against 58 from the former during the period of 246 years from 1658 to 1904.

Comparing the two lists a noteworthy feature is that many of the fisheries held on the Tuticorin banks coincide with blank years on the Ceylon banks.

Thus out of all the Indian fisheries those of 1663, 1669, 1691, 1700, 1784, 1787, 1792, 1805, 1807, 1810, 1818, 1822, 1861, 1862 and 1900, fifteen out of the total of twenty-four, were years in which no fishery took place on the Ceylon side.

Again this fact may be correlated to two others—

(*a*) that usually any particular Indian fishery was preceded at a distance of from two to three years by a Ceylon fishery and

(*b*) that in the same way each Indian fishery was followed at a similar interval by one on the Ceylon banks.

Thus the Indian fisheries of—	were preceded respectively by Ceylon fisheries held in—
1669	1666, 1667.
1700	1695—1697.
1747—1749	1746.
1805	1799, 1803 and 1804.
1807	1804, 1806.
1810	1806, 1808.
1815	1809, 1814.
1818	1814—1816.
1822	1820.
1830	1828, 1829.
1860—1862	1857—1860.
1889, 1890	1884, 1887.

while in the same way the Indian fisheries of—	were followed respectively by Ceylon fisheries in—
1663	1666, 1667.
1691	1694—1697.
1747—1749	1750, 1753 and 1754.
1792	1796.
1805	1806, 1808.
1807 and 1810	1809, 1814.
1815	1816, 1820.
1818	1820.
1822	1828.
1828	1829—1833.
1830	1831—1833 and 1835.
1860—1862	1863.
1900	1903, 1904.

Such regularity of alternative succession extending over 75 per cent. of the fisheries held on the Indian side appears to be more than a mere coincidence and lends weight to an opinion that has gradually been taking shape and developing in my mind that the beds on the opposite sides of the Gulf confer reciprocal benefits upon one another and that the Ceylon banks are frequently replenished from those off the Madura coast and, conversely, that the latter obtain most of their deposits of spat from the Ceylon side.

The following table furnishes the valuation particulars of the last sample of oysters lifted from a Tuticorin bank:—

Statement of the valuation and produce of 8,500 *oysters lifted from the Teradipulipiditta Par in October* 1899.

Description.	Size in basket.	Number.	Quantity in chevu.	Weight.		Total.		Total value.	Per chevu.	Per kalanji.
				Kalanji.	Manjady.	Kalanji.	Manjady.	RS. A. P.	STAR PGDS.	STAR PGDS.
Ani	50	1	$\frac{8}{320}$	..	$\frac{3}{16}$	..	$\frac{3}{16}$	7 0 0	80	..
	80	1	$\frac{5}{320}$	..	$\frac{5}{32}$	..	$\frac{5}{32}$	4 6 0	80	..
Anatari	80	3	$\frac{20}{320}$	..	$\frac{1}{2}$	..	$\frac{1}{2}$	9 10 0	45	..
Kuruwal	20	2	..	..	$\frac{3}{4}$	..	$\frac{3}{4}$	7 14 0	..	60
Kalippu	20	1	} $\frac{64}{320}$	..	$\frac{1}{2}$	..	$\frac{1}{2}$	} 12 0 0	20	..
Podi Kalippu	80	1		..	$\frac{1}{8}$	..	$\frac{1}{8}$			..
Pisal	..	..	..	..	$1\frac{1}{2}$	..	$1\frac{1}{2}$	0 6 0	..	$1\frac{1}{3}$
Vadivu	100, 200, 400	..	..	..	3	..	3	31 8 0	..	60
Tul	600, 800, 1,000	..	..	..	$6\frac{1}{2}$	..	$6\frac{1}{2}$	9 12 0	..	$8\frac{1}{2}$
Masitul	..	..	..	..	$5\frac{3}{4}$	..	$5\frac{3}{4}$	2 14 0	..	..
Shell pearls	..	..	..	..	$6\frac{1}{2}$	..	$6\frac{1}{2}$	0 12 0	..	..
Total	..	..	..	..	..	..	..	86 2 0	..	..
Average per 1,000 oysters	..	..	..	..	..	..	..	10 2 0	..	..

II.

NOTE ON THE TOPOGRAPHY OF THE BANKS.

The charted pearl banks along the Indian Coast of the Gulf of Mannar represent all those patches of rocky ground lying within the 10-fathom line known to the fishermen of that coast. Taken as a whole they deserve the name of pearl banks only so far as being so potentially. The number of these banks which have been known to bear mature oysters during the past century is limited to 23 at most, and except in the case of nine, none of them has been fished more than once in this long period. These potential pearl banks extend from Cape Comorin to Raméswaram Island at the extreme head of the Gulf, a distance of over 100 miles. They consist of whatever rocky outcrops there are upon the surface of the wide sub-marine plateau which fringes the whole extent of this coast. This pearl bank plateau is widest in the south, in the neighbourhood of Cape Comorin, gradually narrowing as we proceed northwards. In the south it shelves to the 100-fathom line at an easy gradient, and everywhere the width of the plateau is considerably greater than anywhere in the pearl bank region on the Ceylon side.

The pars, as these banks are termed locally, may be arranged in three divisions :—the Northern or Kilakarai, extending from Adam's bridge to Vaipar ; the Central or Tuticorin, from Vaipar to the latitude of Manapad ; and the Southern or Comorin from thence southwards to Cape Comorin.

The Central division is by far the most important ; indeed so far as recent historical evidence goes the banks of this division are the only productive ones.

Many are extremely small ; some have been described as having an area little greater than that of an ordinary sized room, and as they owe their separate entities to the detailed local knowledge of fishermen engaged not in pearling but in ordinary fishing it will conduce greatly to simplify the pearl bank management if, in future, the majority of these separate banks instead of being listed individually, be linked together into groups, the members of each group occupying adjacent positions and having similar physical and biological characteristics ; some have characters rendering them entirely unsuited to the maturing of oysters and these may be deleted eventually once and for all.

The names of these banks arranged in order from north to south and classified into groups consonant with their relative geographical position and with their identity of physical and biological characteristics are as follows :—

A.—Northern or Kilakarai Division.

	Composed of.
I. Pámban Group	1. Pámban Karai Par. 2. Pámban Velangu Par.
II. Musal Tivu Group	3. Musal Tivu Par. 4. Solaka Karai Par.
III. Kilakarai Group	5. Kilakarai Vellai Malai Velangu Par. 6. Vellai Malai Karai Par. 7. Anna Par.
IV. Tanni Tivu Group	8. Nalla Tanni Tivu Par. 9. Uppu Tanni Tivu Par.
V. Vembar Group	10. Kumulam Par. 11. Vembar Periya Par.

B.—Central or Tuticorin Division.

VI. Outer Vaipar Group	12. Vaipar Periya Par.
VII. Inner Vaipar Group	13. Karai Par. 14. Devi Par. 15. Pernandu Par. 16. Padutta Marikan Par. 17. Padutta Marikan Tundu Par.

B.—Central or Tuticorin Division—cont.

Group	No.	Par
VIII. Cruxian Group	18.	Tuticorin Kuda Par.
	19.	Cruxian Par.
	20.	Cruxian Tundu Par.
	21.	Vantivu Arupagam Par.
IX. Utti Group	22.	Nagara Par.
	23.	Utti Par.
	24.	Uduruvi Par.
	25.	Kilati Par.
	26.	Attuvai Arupagam Par.
	27.	Attonpatu Par.
X. Pasi Par Group	28.	Pasi Par.
	28A.	Pattarai Par.
XI. Tolayiram Par	29.	Kutadiar Par.
	30.	Tolayiram Par.
XII. Puli Pundu Group	31.	Vada Onpatu Par.
	31A.	Saith Onpatu Par.
	32.	Puli Pundu Par.
	32A.	Kanna Puli Pundu Par.
XIII. Kanna Tivu Group	34.	Kanna Tivu Arupagam Par, and perhaps
	35.	Tundu Par.
XIV. Nenjurichchan Group	36.	Nenjurichchan Par.
	36A.	Par Kundanjan Par.
	36B.	Mela Onpatu Par.
XV. Inner Kudamuttu Group .	37.	Pinnacoil Seltan Par.
	38.	Sandamaram Piditta Par.
	39.	Irai Tivu Kudamuttu Par.
	39A.	Nadu Kudamuttu Par.
	41.	Kudamuttu Par.
	41A.	Rajavukku Sippi Sotichcha Par.
	41B.	Saith Kudamuttu Par.
XVI. Outer Kudamuttu Group ...	40.	Kovil Piditta Pattu Par.
	40A.	Sankuraiya Pattu Par.
	40B.	Nillan Kallu Par.
	40C.	Sattu Kuraiya Pattu Par.
XVII. Kadeiyan Group	43.	Kadeiyan Par.
	43A.	Kanawa Par.
	43B.	Putu Par.
XVIII. Karuwal Par	42.	Naduvu Malai Piditta Par.
	42A.	Periya Malai Piditta Par.
	44.	Karai Karuwal Par.
	45.	Velangu Karuwal Par.
XIX. Odakarai Group	48.	Odakarai Par.
XX. Chodi Group	49.	Chodi Par.
XXI. Tundu Par Group	46.	Tundu Par.
XXII. Manapad Group	47.	Trichendur Puntoddam Par.
	50.	Sandamacoil Piditta Par.
	51.	Teradi Piditta Par.
	52.	Semman Path Par.
	53.	Surukku Onpatu Par.

C.—Southern or Comorin Division.

XXIII. Manapad Periya Par.

The remainder of the Southern banks cannot at present be grouped, as their positions are not marked on the Inspection Chart, and as I have had no opportunity to examine them. Their names will be found in the list on page 107 numbered from 55 onwards.

Central or Tuticorin Group.—The Central division corresponds both in latitude and in extent with the productive pearl bank region on the opposite Ceylon coast, Manapad point coinciding exactly with the latitude of the Ceylon Muttuvaratu Par, while the Tolayiram Par, off Tuticorin, similarly coincides, as well in latitude as in great relative extent, with the Cheval Par, the bank of largest area and greatest productive importance on the Ceylon side.

The great majority of the pars are marshalled roughly in line parallel with and at a distance of from 7 to 8 miles from land. From Kayalpattanam to Vaipar a second and outer series occurs, lying in rather deeper water. The depth of the inner series is in the main 7 to 8 fathoms, that of the outer 8 to 11 fathoms.

The *surface* of these pars consists of a rock which appears in many instances to be of recent origin, rock formed by the consolidation of sand and dead corals *in situ.* The nature of the rock varies considerably, partaking usually largely of the present character of the circumjacent sand and as the latter on this portion of the Indian coast is made up principally of calcareous grains formed from the comminuted remains of shells and corals, so the calcrete is normally a more or less pure limestone. Occasionally the remains of corals are met with, and here and there the calcrete contains a varying amount of quartz sand. The proportion of quartz in no case is so great as that characterizing the typical quartzose calcrete so common on the Ceylon side. In several localities visited during the inspection, I am, however, of opinion that the exposed rock surfaces are not of contemporary origin, being of limestone too hard and compact to be considered a modern calcrete. Further, where such latter calcrete does occur, it appears to me to form but a comparatively thin crust over the underlying more compact bed-rock of the plateau whereof the density and grain appeal to me as significantly identical with the extremely hard, compact rock forming the core of the Jaffna islands and peninsula in the north of Ceylon.

In no place did I see any shelly conglomerate, no rock in which the main constituent could be made out as formed from the accumulation of shells of pearl oysters, cockles and the like.

It is impossible to say with any certainty whether the banks which appear at the present day to be the only banks from which we can reasonably expect to reap an occasional pearl harvest, have always had this character or whether the banks which were productive centuries ago and anterior to the advent of European control were situated further south. Certain facts and inferences incline me to suspect that the latter was, to some extent at least, the case. There seems to be considerable evidence pointing to a considerable extension southwards of the Indian Peninsula at a comparatively recent geological period. Without going into details as regards this it will suffice to point out the great extent of shoals and of shallow water lying off Cape Comorin and to the statement in the ancient Tamil epic "Chilappatikáram" where in the opening lines of the 8th Chapter reference is made to a terrible irruption of the sea which devastated a great tract of country to the south of what is now Cape Comorin. The passage states * that the people of that time (circa second century A.D.) had heard from their fathers that in former days the land had extended further south, and that a mountain called Kumarikkodu and a large tract of country watered by the river Pahruli had existed south of Cape Kumari, and that at a time not very long before, in the reign of the Pandyan King Jayamakirtti *alias* Nilantarutiruvit Pandya, the sea had torn through the land, destroying the mountain Kumarikkodu and submerging the whole of the country through which flowed the river Pahruli.

Lending corroborative weight to this legend are the stories of similar irruptions of the sea on the south-west coast of Ceylon recorded in the Buddhist annals of that country. Even now these stories are current among the Sinhalese of the south, who point to the outlying rocks known as the Basses, as the remnant of this lost land which they say was a land of richness abounding in towns and palaces.

In this connection too we have to note the significant fact of the reported presence of large accumulations of oyster shells overlaid by soil at Muttam, about two miles north-east of Cape Comorin.†

This presence of an old pearl fishery camp within two miles of the Cape lends further support to the theory of a great extension southwards of the pearl fishery region and while not conclusive as evidence add greatly to the physiographical probabilities of such a hypothesis.

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* *Fide* V. Kanakasabhai in "The Tamils Eighteen hundred years ago", Madras, 1904, p. 21.
† *Fide* the statement made to me to this effect in May last by the Jati Talaivan from his personal knowledge.

At a time when the southern extremity of India extended further to the south, the pearl banks on both sides of the Gulf of Mannar would have greater protection from the South-West monsoon than they have at present while the extent of suitable ground would be more extensive. At the present day on the coast of Tinnevelly and Madura a converse process is in operation, the land slowly gaining upon the sea along the coast line facing the central division of the pearl banks. Two factors are at work—the extension of fringing coral reefs along the coast and the distribution upon the sea bottom of considerable quantities of sand and mud brought down by the rivers Tambrapurni, Vaipar, and Vembar. There is also a constant movement of sand northwards during the prevalence of the South-West monsoon, whereby the depth of the water on this pearl bank plateau may possibly be rendered shallower and gain some extension seawards.

III.

MEANING AND DERIVATION OF THE NAMES OF THE PRINCIPAL PEARL BANKS OFF THE MADURA COAST.

Numbers.	Names of the Pars as they appear in the Inspection Reports	Names of the Pars in the improved orthographic forms now recommended for adoption.	Signification.	Derivation and remarks.
1	Pámban Karia Par ..	Pámban Karai Par ..	Pámban inshore bank, *i.e.*, Pámban inner bank.	Karai, shore; par, rock and by extension of meaning, rocky bank.
2	Velangu Par	Pámban Velangu Par ..	The bank near Pámban lying further from shore, *i.e.*, Pámban outer bank.	Velangu, further.
3	Musal Thivu Par ..	Musal Tivu Par	Bank lying near Hare Island.	Musal, hare; tivu, island.
4	Cholava Karai Par ..	Solaka Karai Par ..	Bank lying off the south shore (of Rámésvaram.)	Solaka (cholaka) south; Karai, shore. Cholava probably a misprint for cholaka, which is the fishermen's term for south. "Ten" is the south of the landsman.
5	Kilakarai Vallia Malai Velangu Par.	Kilakarai Vellai Malai Velangu Par.	Outer bank off the white hill at Kilakarai (Kilakarai, literally the East Coast).	Kilai, east; Karai, shore; vellai, white; malai, hill; velangu, further or outer (Kilakarai a port on the east coast).
6	Vallia Malai Karai Par ..	Vellai Malai Karai Par ..	Inner bank off Vellai Malai.	Karai, inshore *i.e.*, inner in contrast to Velangu, outer. Vellai Malai, a white and conspicuous sand dune near Kilakarai.
7	Anna Par	Anna Par	?	Anna or annam signifies swan.
8	Nallathanni Thívu Par ..	Nalla Tanni Tivu Par ..	Nalla Tanni Tivu bank ..	Nalla, fresh; tanni, water; tivu, island. Nalla Tanni Tivu is an island in the Zamindari of Ramnad where excellent fresh water is obtainable from shallow wells.
9	Uppathanni Thivu Par ..	Uppu Tanni Tivu Par ..	Uppu Tanni Tivu bank ..	Uppu, salt. An island close to Nalla Tanni Tivu where the wells are brackish.
10	Kumulam Par	Kumulam Par	Probably this is "the bank abounding in hemispherical stones".	Kumulam, a blister-like swelling, is applied to the hemispherical masses of Astræid corals so common on certain sandy oyster banks.
11	Vembar Peria Par ..	Vembar Periya Par ..	Large bank lying off Vembar village.	Periya, large.
12	Vaippar Peria Par ..	Vaippar Periya Par ..	Large bank lying off Vaippar village.	....
13	Karai Par	Karai Par	Bank lying towards the shore.	Karai, shore.
14	Devi Par	Devi Par	Probably "the Rani's bank."	Devi, a titular suffix to the names of the Rani of Ramnad and of Madura; primarily the name of a goddess (Siva's wife).
15	Pernandu Par	Pernandu Par	Fernando's bank	Probably first found by a fisherman of this name.
16	Padutha Marikan Par ..	Padutta Marikan Par ..	Bank whereon Marikan (a Mussalman) was found lying (dead).	Paduttiru, lying down. Marikan or Marikar appended to Muhammadan names is a relic of an honorofic bestowed by the Portuguese upon prominent Muhammadans.
17	Padutha Marikan Par Thundu.	Padutta Marikan Tundu Par.	The small bank close to the preceding.	Tundu, fragment.
18	Tuticorin Coda Par ..	Tuticorin Kuda Par ..	The bank off Tuticorin Bay.	Kuda, bay; primarily a cavity or hollow.
19	Cruxian Par	Cruxian Par	Bank of the cross ..	Kroos (curusu), a corruption of the Portuguese Cruz, cross.
20	Cruxian Thundu Par ..	Cruxian Tundu Par ..	Small Cruxian bank ..	Tundu, a fragment (small).

Meaning and derivation of the names of the Principal Pearl Banks off the Madura Coast—cont.

Numbers.	Names of the Pars as they appear in the Inspection Reports.	Names of the Pars in the improved orthographic forms now recommended for adoption.	Signification.	Derivation and remarks.
21	Vanthivu Arupajam Par.	Vantivu Arupagam Par..	Bank off Vantivu in six fathoms (Vantivu, hard white rock island).	Aru, six; pagam, fathom; van, hard. Vantivu, a small island, north of Tuticorin on which there is a small fishing beacon; probably so called on account of hard white rock there present.
22	Nagara Par	Nagara Par	Bank abounding in a fish called nagara.	Nagara, the name of a fish.
23	Ootti Par	Utti Par	Snail bank	Otti or Utti, a snail-like mollusc. Probably a corrupt form of *Uri*, the name of a small spiral shell-fish (gastropod) that is an active enemy of the pearl oyster during the first four months of life.
24	Oodurnvi Par	Uduruvi Par	Possibly has reference to a cavernous condition of the rock, enabling fish to pass in and out of the cavities.	Uduruvi, penetrating or passing through.
25	Klatti Par	Kilati Par	Bank abounding in trigger fish.	Kilati, trigger fish (*Balistes mitis* is the most abundant species on this coast).
26	Athnvai Arupajam Par ..	Attuvai Arnpagam Par ..	Bank near mouth of the river in six fathoms.	Attuvai, mouth of a river (attu, river; vai, mouth) aru, six; pagam, fathom.
27	Athombadu Par	Attonpatu Par	9 (fathom) bank off the river.	Attu, river; onpatu, nine (ombadu, a corrupt form of onpatu).
28	Pasi Par	Pasi Par	Sea-weed bank	Pasi, sea-weed (literally moss).
28*a*	Patharan Par	Pattarai Par	$10\frac{1}{2}$ (fathom) bank (?) ..	Pattu, ten; arai, half.
29	Kuthadiar Par	Kutadiar Par	Dancer bank (?)	Kutadian, a dancer.
30	Tholayiram Par	Tolayiram Par	900 banks	Tolayiram, 900. A large bank characterized by numerous small patches of rock rising from a sandy bottom.
31	Vadda Ombathu Par ..	Vada Onpatu Par ..	Northern bank in nine fathoms.	Vada, north.
31*a*	Saith Ombathu Par ..	Saith Onpatu Par ..	Southern bank in nine fathoms.	Saith, south (a local term derived I think from Portuguese).
32	Puli Pundu Par	Puli Pundu Par	Bank having a tamarind bush as land mark.	Puli, tamarind; pundu, bush.
32*a*	Canna Puli Pundu Par ..	Kanna Puli Pundu Par ..	Bank having a tamarind bush as land mark near Kanna Tivu.	Do.
33	Alluva Par	Alluva Par	Rotten weed bank (?) ..	Alluva, rotten (pasi, sea-weed being understood).
34	Kanna Thivu Arupajam Par.	Kanna Tivu Arupagam Par.	Bank off Kanna Tivu in six fathoms.	Aru, six; pagam, fathom.
35	Thundu Par	Tundu Par	Small bank	Tundu, piece or fragment, *i.e.*, small.
36	Nenjurichan Par ..	Nenjurichchan Par ..	Good for nothing bank ..	Nenjurichchan, good for nothing, literally "heart harrower" from Nenju, heart; Urichchan, flayer or peeler.
36*a*	Par Kudanjan Par ..	Par Kundanjan Par ..	....	....
36*b*	Mela Ombathu Par ..	Mela Onpatu Par ..	Further or outer 9 fathom bank.	Mela, further or distant, outer.
37	Punyacoil Seltan Par ..	Pinnacoil Seltan Par ..	....	Pinnacoil, the name of a large Parawa settlement on the Tinnevelly coast. Coil from Kovil, temple, primarily; now used to signify church among Christianized Tamils, or it may be a corruption of Kayal, which is in the vicinity and a much more ancient town.
38	Sandamaram Puditha Par.	Sandamaram Piditta Par.	Bank where land mark is a tree near a market.	Sanda, a corrupt form of Santai or Chantai, market; maram, tree; piditta, touching, *i.e.*, indicating as does a land mark.

Meaning and derivation of the names of the Principal Pearl Banks off the Madura Coast—cont.

Numbers.	Names of the Pars as they appear in the Inspection Reports.	Names of the Pars in the improved orthographic forms now recommended for adoption.	Signification.	Derivation and remarks.
39	Ira Thivu Cudamuthu Par.	Irai Tivu Kudamuttu Par.	Bank in the Pearl Bay near Irai Tivu.	Irai, literally finger joint, inch; kuda, bay; muttu, pearl.
39*a*	Nadukudamuthu Par ..	Nadu Kudamuttu Par ..	Bank near the middle of the Pearl Bay.	Nadu, middle.
40	Kovilpuditha Puthu Par.	Kovil Piditta Pattu Par.	Bank in 10 fathoms having a church as the leading mark on shore.	Pattu, ten; piditta, touching; kovil, church.
40*a*	Sanguria Puthu Par ..	Sankuraiya Pattu Par ..	Bank where depth is a foot less than 10 fathoms.	San, a span; kuraiya, less (short of).
40*b*	Nilankalla Par	Nilan Kallu Par	Blue stone bank	Nilam, blue; kallu, stone.
40*c*	Sethu curia Pathu Par ..	Sattu Kuraiya Pattu Par.	Bank a little less than in 10 fathoms.	Sattu, a little; kuraiya, less; pattu, ten.
41	Kudamuthi Par	Kuda Muttu Par	Pearl Bay bank	Kuda, bay; muttu, pearl.
41*a*	Rajavukku Sippi Sothicha Par.	Rajavukku Sippi Sotichcha Par.	Bank searched for oysters for the Raja.	Rajavukku, for or to a Raja; sotichcha, searched or examined; sippi, oyster.
41*b*	Saith Kudamuthi Par ..	Saith Kuda Muttu Par ..	South bank in the Pearl Bay.	Saith, south (Portuguese or English ?).
42	Naduvu malai Puditha Par.	Naduvu Malai Piditta Par.	Bank touching or on the bearing of a peak of the Western Ghats.	Piditta, touching; Naduvu malai, Western Ghats (naduvu, central; malai, hill).
42*a*	Peria Malai Puditha Par.	Periya Malai Piditta Par.	Bank touching the great hill.	Periya, great.
43	Kadian Par	Kadeiyan Par	The Lime-burners' bank.	The Kadaiyar caste is that of the lime-burners; it however furnishes a contingent of men who work as divers at the chank and pearl fisheries.
43*a*	Kanava Par	Kanawa Par	Bank abounding in cuttle fish.	Kanawa, cuttle fish.
43*b*	Puthu Par	Putu Par	New bank	Putu, new.
44	Karia Karwal Par ..	Karai Karuwal Par ..	In-shore black bank ..	Karuwal, black; probably from the colour of the surface of the rock.
45	Velangu Karwal Par ..	Velaugu Karuwal Par ..	Off-shore black bank ..	Velangu, further; karuwal, black.
46	Thundu Par	Tundu Par	Small bank	Tundu, fragment.
47	Tricheudore Puuthotta Par.	Trichendur Puntoddam Par.	Trichendur flower garden bank.	Puntoddam, flower garden; probably so named on account of some pretty species of sea-weed or other marine organism found on this bank.
48	Odacarai Par	Oda Karai Par	Narrow bank towards the shore.	Odai, narrow; karai, shore.
48*a*	....	Oda Karai Tundu Par ..	Small Odakarai bank ..	*Vide* 46 and 48.
49	Chowdi Par . ..	Chodi Par	Ornamental bank ..	Chodi, to adorn.
50	Sandamacoil Puditha Par.	Sandamacoil Piditta Par.	Bank touching St. Mary's Church, *i.e.*, where St. Mary's Church is the principle bearing.	Sandamacoil, St. Mary's Church; Sandama, holy or blessed mother, *i.e*, St. Mary (Sancta Maria); Kovil, church.
51	Theradi Puditha Par ..	Teradi Piditta Par ..	Bank having Trichendur pagoda as land mark.	Ter, car; teradi, place where car is kept, *i.e*, pagoda or temple.
52	Semmau Patti Par ..	Semman Path Par ..	Red hill bank (red hill is the bearing).	Sem-man, red sand or earth; path, a hill (?).
53	Surukku Ombathu Par ..	Surukku Onpatu Par ..	Bank falling quickly into 9 fathoms, *i.e.*, a rapidly shelving bank (this is the case, it is a narrow bank $5\frac{1}{2}$ fathoms deep on the west side, 8 fathoms deep on the east).	Ombathu, nine (a corrupt form of Onpatu); surukku, quickly.
54	Manapad Peria Par ..	Manapad Periya Par ..	Large Bank off Manapad.	Manapad, name of a promontory.
55	Kanawa Paraku Sohi Thundu Par.	Kanawa Parakku Sohi Par.	The bank of the highly coloured flying cuttle fish (?).	Kanawa, cuttle fish; parakku, flying; sohi, well-dressed or adorned (?).
56	Paracherry Par ..	Paracherry Par	The bank off the Pariah village.	Cheri, village; paraiyan, pariah (drummer).
57	Paracherry Pathoor ..	Paracherry Pathoor (? Pattu Par).	10-fathom bank off the Pariah village (?).	It is possible that Pathoor is a misrendering for Pattu Par. I have had, however, no opportunity to examine this region and do not know whether the depth is 10 fathoms or not. *Pattoor* may also signify the "10 villages", but the context does not support this reading.
58	Alanthalai Pathoor ..	Alantalai Pathoor (? Pattu Par)	The 10-fathom bank off Alantalai (?).	
59	Manapad Pathoor ..	Manapad Pathoor (? Pattu Par).	Manapad 10-fathom bank (?).	

Meaning and derivation of the names of the Principal Pearl Banks off the Madura Coast—cont.

Numbers.	Names of the Pars as they appear in the Inspection Reports.	Names of the Pars in the improved orthographic forms now recommended for adoption.	Signification.	Derivation and remarks.
60	Keelee Par	Kili Par	Bank abounding in parrot-fish.	Kili, the name of a small fish (parrot-fish).
61	Peria Thalai Seman Tharai Par.	Poriya Talai Seman Tarai Par.	Bank lying near the great head (land) of red earth.	Poriya, large; talai, head; seman, red; tarai, earth (Latin, *terra*).
62	Soman Pallei Kathu Par.	Siman Pillai Katha Par.	Possibly this means "the bank guarded by Siman Pillai."	Siman Pillai, a man's name. Katha, guarded by.
63	Kodoo Thalai Par ..	Kuda Talai Par	The bank at the head of the bay (?)	Kuda, bay; talai, head.
64	Ovaree Anthoniar Kovil Puditha Par.	Ovari Anthoniar Kovil Piditta Par.	Bank touching St. Anthony's church at Ovari, *i.e.*, on the bearing of this church.	Ovari, the name of a village. Anthoniar kovil, St. Anthony's church.
65	Ovaree Anthoniar kovil Vallai Velai Par.	Ovari Anthoniar kovil Vallai Velai Par.	?	..

Note on the system of transliteration adopted.—Throughout this report I have attempted to be consistent in the transliteration of Tamil names. The system followed is that in official use in Ceylon.

IV.

NARRATIVE OF THE EXAMINATION OF THE PEARL BANK REGION.

As knowledge of the observations made during the May cruises of the S.S. "Margarita" is essential to a full understanding of my recommendations, it will be convenient if I give the record in the character of a narrative altering as little as possible the form in which it stands in my diary.

No attempt is made to furnish extensive lists of the animals found. Single-handed the task is an impossibility, while the limitations of time do not permit the reference of the collections to specialists. I have however expended considerable time and labour upon the identification of those organisms that are characteristic of certain banks--all those that predominate or have special significance are either signalized by name or by description. The present identification is sufficient for the purposes of comparison; the rarer and smaller animals may well be left for detailed examination at a subsequent period.

The programme of investigation which I mapped out before leaving Ceylon consisted of three main lines—

(*a*) The examination of the sea-bottom in the pearl-bank region on the Indian side of the Gulf of Mannaar, for the purpose of the institution of both physical and biological comparisons between these banks and those with which I am now so intimately acquainted on the Ceylon side.

(*b*) An enquiry into the present methods in use for the inspection of the banks, and the means, if considered necessary, requisite to render the work of inspection adequately effective.

(*c*) A critical examination of the historical evidence available, inspection and fishery reports in particular, in order to ascertain what localities the past records demonstrate to be more favourably situated than others for bringing pearl oysters to maturity.

The present section deals almost entirely with the first mentioned of these lines of enquiry; the historical evidence gleaned during the trip is incorporated with other data in another section.

The Ceylon Pearl fishery closed by reason of unfavourable fishing weather on April 22nd this year, but in the hope that the Indian coast might enjoy sufficient shelter to permit of useful work being done ere the monsoon came on in full fury, I telegraphed my preparedness to Captain Carlyon, the Port Officer of Tuticorin. Accordingly on the morning of the 26th, the S.S. "Margarita" arrived at Marichchukadde under the command of Captain Carlyon who also acts as Superintendent of the Indian Pearl Banks. Some hours were occupied in the transfer of baggage and by nightfall we proceeded for Pámban, having in tow three of the Ceylon inspection whale boats.

A heavy sea prevailed during the passage, rendering it one of much discomfort. On arrival at Pámban the next morning, it was decided to make Tuticorin by the sheltered passage formed by the string of islands that skirt the coast for the greater part of the distance between these two ports.

Anxious to see the important Muhammadan diving community of Lubbais * settled at Kilakarai we put in there on the afternoon of April 27th. Accompanied by Captain Carlyon I went ashore and by the courtesy of the Gomez family we were enabled to interview the headmen of the divers in their house—Xavier Gomez, who had been one of the assistant beach-masters at the Ceylon Fishery, acting as interpreter.

* In Ceylon these men are known as "Moormen."

The head diver, M. Kirutuneina, who claims to be 70 years old and to have dived from the age of nine, had much to say, but few facts of consequence were elicited ; he and the other elders had never known or heard of mature pearl oysters in quantity on any of the Pars between Kilakarai and Pámban. The nearest locality they knew of was the vicinity of Nallatanni-tivu, and even there they had never seen a bed of living oysters, the evidence as regards this locality resting entirely upon the abundance of old oyster shells that litter the sand hills of that island.

In Kilakarai, signs of prosperity were visible everywhere; boat-owners were arranging for the building of new craft, their agents gone to Cochin for timber; diver-fishermen were investing in new nets and goldsmiths were busy with orders for jewellery for the womenfolk. The talk everywhere was of money, of profits past and prospective, individual and collective, and of their determination to send more boats and divers to the next year's Ceylon fishery which they were already exploiting in imagination ! Incidentally the head diver informed us that as the result of careful calculation, the best informed people of the place estimated that this one town had brought away from the Ceylon fishery a sum of fully ten lacs of rupees—the earnings of the divers, munduks, and boatmen, and the profits of the pearl merchants and boutique keepers—a sum equal to the gross proceeds received by the Ceylon Government from their share of the fishery.

This year the high profits made at the Ceylon fishery were doubly welcome as being unexpected, news having been universally circulated at the end of last year (1903) that, as the result of the November inspection of the banks had proved disappointing, no fishery would take place.

The Kilakarai men are the best and most reliable of the local divers who attend the pearl fisheries of the Gulf of Mannar. Their abstemious lives consequent upon fairly faithful observance of the Prophet's laws, predispose to health and regularity of working and while more industrious than the Roman Catholic Parawa divers they also make better use of their earnings than do the latter, who, I am assured on all sides—even by their own people—dissipate their fishery gains within a month or six weeks of their return home. Indeed I was told subsequently in Tuticorin, that the great majority of the Parawas will do little or no work till they have got rid of their earnings in drink and in entertainments and are penniless once again.

A small settlement of Parawas, dominated as usual by a whitewashed Roman Catholic Church, is set within circumscribed limits on the seaward margin of the town of Kilakarai. Few physical differences that cannot be accounted for by the great divergence between their modes of life can be noted between them and their Lubbai neighbours and I incline to the belief that in the Kilakarai Muhammadans we have the descendants of Tamil fisher converts to Islam, just as the Parawas have become Roman Catholics. Indeed I cannot help thinking that the Parawas and Kilakarai Lubbais are identical in origin, but in the absence of anthropometric measurements the point cannot be settled definitely.

Leaving Kilakarai the next morning we proceeded direct to Tuticorin, landing there on the afternoon of April 28th.

The ensuing three days were spent in completing the necessary preparations for work at sea, getting coal and water aboard the steamer, and, on my part, in interviewing every resident in any way likely to have shrewd opinions based upon local intimacy with the pearl bank region and in comparing and abstracting the information contained in the fishery and inspection records. Unfortunately the latter are all of comparatively recent date, none going back to the period of the Dutch occupation—a *lacuna* which I was subsequently able to fill in great part by the collation and collection of references which occur incidentally in various and diverse publications.

The Government records give the names of over 60 párs which are reckoned as potential oyster banks. Reference to charts A and B in the appendix, shows that the majority are massed offshore between Tuticorin and Trichendur in from 6 to 10 fathoms of water. This region includes practically all the banks that have yielded fisheries during the present century and accordingly it was decided to make our first cruise over the area thus indicated.

Tolayiram Par.—Accordingly on May 2nd we left Tuticorin at 6-30 A.M. and proceeded to the south end of the Tolayiram Pár, about 8 miles to the east of Hare island. There we commenced the examination, the day's work extending over the southern half of the bank, with traverses extending some distance beyond the charted margin. This bank, which yielded fisheries in 1784, 1787, 1807, 1810, 1822, 1830, 1889 and 1890, has generally been considered one of the most favourable for rearing oysters to maturity, and to be fully the equal of any other bank in respect to the number of spat falls reported upon it during the past half century.

It possesses by far the largest area of any productive Indian bank, its charted outline being 7 miles long with a width varying from one mile to two miles. The depth varies from 8 to 11 fathoms. Our examination showed the bank to consist of a somewhat uneven, but not rugged, rocky framework rendered level by the accumulation of sand in the depressions. Here and there the rock shows bare save for a thin veil of sand, but the greater part is covered by sand varying from 1 and 2 inches to 6 inches and a foot in depth.

The sandy bottom appears to the divers as broken up by a multitude of rocky outcrops usually of limited extent and from this circumstance we may infer the origin and propriety of the name "Tolayiram," literally "nine hundred".

The surface of the bank shows considerable local diversity—both physical and faunistic. In some places a rocky surface sprinkled lightly with sand bears loose blocks of calcrete (recently formed rock) of varying size; elsewhere fragments of Madrepore coral branches, corroded and water-worn, lie loose, here sparsely scattered, there abundant. In other places deep sand, bare of any life, largely preponderates. Variation in every proportion is represented.

The sand is altogether different from that on the Ceylon side. Instead of being clean large-grained quartz grit, as there, the sand of the Tolayiram pár is fine in grain, the angles well rounded; chemically it is composed principally of calcium carbonate—comminuted shell fragments in the main.

In colour it is yellowish brown and there is always associated with it a certain, though variable, amount of mud particles, which rise with every movement upon the bottom—the scramble of the divers, the under-tow of strong currents.

The majority of the diving descents made upon the bank proper showed the greater part of the area examined to be thickly covered with young oysters from one month to six months old, those of three to four months of age preponderating. The sizes varied from $10 \times 10\frac{1}{2} \times 3\frac{1}{2}$ millimetres to $24 \times 22 \times 8\frac{1}{2}$ millimetres. The weight of 100 individuals of average size was 99·65 grammes.

The general facies of the bank approximates closely to that of the Ceylon Periya pár—a bank noted for the frequence of spat falls upon it; both are of great extent and of diversified character and both lie all but out of sight of land towards the edge of soundings. Great quantities of young oysters were found on the Ceylon bank named in March last, practically of the same age as those on the Tolayiram pár, but on the whole the abundance was distinctly less on the latter bank, while the sand leaves less extent of rock exposed.

Considerable destruction of the young oysters was apparent, and large numbers of empty shells were found. Of the latter a small proportion, 1 in 14, bore evidence in the presence of circularly bored holes, to destruction by small carnivorous gastropod molluscs (belonging to the genera *Purpura*, *Nassa* and *Sistrum*) termed *Uri* by the divers. The great majority, however, furnished no indication to show by what agency death had been caused. Consideration of what the chief harmful factor is and how it acts will be dealt with when we deal with the conclusions.

Characteristic organisms are few in number; sponges predominate, the black crests of *Spongionella nigra* being frequent wherever the sand thins away. The pink *Petrosia testudinaria* is also common, its truncate massive pile increasing the resemblance to a miniature volcano by possessing a crater-shaped excavation upon the summit. Other massive but less conspicuous species are equally abundant, and in some cases, I found the rapid growth of these sponges entailing the destruction of many young oysters, enwrapping and smothering them, as evidenced by the empty shells embedded in the sponge mass. *Axinella donnani* is occasionally met with.

Corals were scarce. Occasionally locally-isolated colonies, usually small in size, were found, nearly all being *Porites*, *Meandrina*, and Astræids.

Still less common were Alcyonarians, represented by *Sarcophyton* sp. *Vermetus* was common on the fragments of calcrete, and the lovely star-fish, *Pentaceros lincki*, a known enemy of the pearl oyster, was present in considerable numbers. *Linckia laevigata* was also taken, with *Antedon palmata* in crevices of the exposed rock. Little or no algae was present.

In our traverses zig-zag across the bank we several times passed beyond the margin of the pár on the westward side, finding there bare and barren sand with an occasional chank (*Turbinella rapa*).

After completing the day's work we anchored on the south end of the pár in nine fathoms, and within an hour the crew had caught 16 *Kilati* (Trigger-fishes, *Balistes mitis*). Several were examined and in the stomachs of all were found fragments of several kinds of shells, those of young pearl oysters predominating in many.

The *Parmandadai* or "Rock-pilot" who is taken out by the Inspector to help in locating the banks informed me that this bank has always been noted for the great abundance of Kilati; one ballam usually brings back a catch of 100 fish from this neighbourhood.

During the day the current set strongly from the north, the steamer drifting rapidly when not steaming. The temperature of the sea at 7 A.M. was 87° F. and at 5 P.M. 88° F. The specific gravity was 1,022·80 at 7 A.M.

The following morning, May 3rd, on heaving the anchor up, 18 pearl oysters approximately 6 weeks old, all being of the same size, were found attached to the chain near the anchor end, each by several strands of byssus. All were attached to that part of the chain which would occasionally rest upon the ground—the last two fathoms. It is noteworthy that none of the older sizes were found on the chain, although varying ages were found on this spot.

UTI PAR GROUP.—This region comprising Uti, Nagara, Uduruvi, Kilati, Atuvaiarpagam and Pattarai Párs was next examined first by means of diving traverses on May 4th and on the ensuing day by the method of circle inspection as used on the Ceylon side and which is described in detail *infra* on page 75.

The párs in this group are small and with advantage may be considered as one, under the above title—Uti Pár Group. The depth is less than the mean on the Tolayiram, averaging here from 7 to 8½ fathoms.

In all, nearly 350 dives were made in the course of an examination by circle inspection—a method described fully on page 74.

The centre of the circle was fixed at a point which Captain Carlyon believed from the bearings to lie just on the east margin of the Uti pár, but that bank the pár mandadai said was really to the south-east. The results proved the latter to be right and the Inspector to be wrong, a false position for the latter to occupy and one that is due entirely to the fact that *no shore marks are indicated on the chart in use.* No Inspector can be expected to do good work under present conditions.

The matter presents no difficulties; the landmarks, which consist of Hare Island Lighthouse, the factory chimneys at Tuticorin and the beacon on Vantivu, are clearly distinguishable from these banks, and I should think the Survey office could, from the materials already available plot the position of the several objects with exactitude and without further survey.

The whole of the Uti pár was gone over together with the southern portion of the Nagara pár, the result showing that but a few odd living oysters remain, aged from 2½ to 3 years old and all more or less over-grown with sponges and other growths. In several cases the largest and most frequent of these crusting sponges, the brick-red *Clathria indica*, completely enveloped the oysters, occupying the whole surface of both valves and rising in numerous bold upgrowths to a height of two and three inches.

The párs constituting the Uti group have absolute identity in fauna and in physical characteristics. The rock of each pár is fairly continuous in its outcrop with much less sand sprinkled over it than in the case of the Tolayiram Pár. To some extent as a consequence of this the fauna is richer in the number of species, in the number of individuals, and in luxuriance of growth.

Sponges are especially abundant. Among the most characteristic are the black-crested *Spongionella nigra*, one specimen of which was partly mantled with a thin crust of crimson-lake Botrylloid; purple-red *Siphonochalina communis* (Carter) bearing frequently a like-tinted *Antedon*, clinging to its tubular branches; the massive *Suberites inconstans* and the oyster-crusting *Clathria indica*.

Several of these sponges, notably *Siphonochalina* and *Suberites*, furnish free quarters to quite a host of diverse lodgers—chief among which are a colourless *Alpheus*, a scarlet *Porcellana*, a small *Gebia* and a long armed spiny Ophiuroid (*Ophiactis savignii*). The last named chiefly affects the large canals of the *Suberites*, more rarely being found within *Siphonochalina*. *Gebia* burrows in the smaller canals of the *Suberites*, while the *Alpheus* and *Porcellana* favour *Siphonochalina* much more than they do *Suberites*, probably because their superior activity enjoys greater freedom in the larger and less tortuous cavities of the former sponge.

Corals and Gorgonoids are scarce, the handsome *Juncella juncea* being the only conspicuous representative found.

Specially characteristic are enormous numbers of the branched parchment-like tubes of a fine Eunicid (*E. tubifex*, Crossland). The empty tubes were made known to science years ago by Professor McIntosh from material received from Dr. E. Thurston, Superintendent of the Madras Museum, but it is only in the present year (1904) that the animal has been described and named. Quite a host of smaller creatures settle upon the surface of the tubes—hydroid zoophytes, polyzoa, and compound ascidians, together with an occasional *Lepas* of a species not yet identified. The last named is of interest in that in colour and outline its appearance approximates so closely to a branch of the Eunicid tube that this may be regarded as a striking case of mimicry or protective adaptation to environment.

Colonial masses of the delicate calcareous tubes of *Filograna* were met with and numerous species of the usual errant worms.

Of Echinoderms, Ophiuroids, *Antedon* spp., and *P. lincki* were abundant. Many of the Antedon appeared, as already noted, to be commensal (?) upon sponges and upon Gorgonoids, while commensal in turn with Antedon I found Decapods and Ophiuroids—the former consisting of a small striped crab and a striped Galatheid, the latter of a small, short-armed black Ophiuroid upon an Antedon of the same hue.

Small Cephalopods (*Polypus* spp.) were numerous; polyzoa and tunicates were universal.

Occasional individuals of a large *Pinna* sp. were found lying prone on the rock and much enveloped with sponge and tunicate growth, barnacles and the like; some bore pearl oysters of about one year old.

To the west of the Uti group of párs a large chank-bed is marked. Here we found rock to be practically absent with a corresponding absence of the faunistic elements noted above. In their place were quantities of chanks (*Turbinella rapa*) and of Pinna shells. The former were mostly small as is to be expected, this being a recognised chank-bed and within easy reach of Tuticorin. Many of the *Pinna* were dead shells; those that were alive were, as is usual on sandy ground, embedded deeply in the sand. Both dead and living bore quantities of large barnacles (*Balanus* sp.).

The rock is of somewhat variable composition, varying from a compact brown limestone, similar to that of the Tolayiram Pár, to rock of a distinctly quartzose nature; the angular quartz grains were embedded in a brown calcareous matrix—a quartzose limestone. The sand of the chank-bed is similar to the component material of the pár, but containing an appreciably greater amount of recognisable shell fragments.

After completion of the inspection of the Uti Pár region, we proceeded south on the afternoon of May 4th in the face of a stiff breeze and heavy sea, anchoring at 5 30 P.M. off Pinnacoil in the shelter afforded by the reef off Kayalpattanam point.

Pinnaeoil is one of the head-quarters of the Parawa caste and a noted Roman Catholic centre. Here St. Francis Xavier laboured with great effect and of the four churches which render the town conspicuous from the sea one is connected by legend with this great missionary's ministrations. It is of Pinnacoil that de Faria y Souza records that (circa. A.D. 1560) the Viceroy of India "sailed to the Island Mannar, where he built a fort and translated thither the inhabitants of Punicale to redeem them from the tyranny of the Nayque, who would fleece them there—Emmanuel Rodrigues Contiuho was left to command there and with him some Franciscans and Jesuits, all satisfied with the equal distribution the Viceroy made of all things." *

A Casuarina-tope is a conspicuous feature of the landscape about two miles south of the town and were its position fixed with accuracy upon the chart it would form a useful and much-needed landmark during the inspection of the pearl banks.

The Jati Talaivan has informed me that an old pearl-fishery camp at one time was situated just south of the trees of the tope as evidenced by this place being now called Silavaturai kadu (jungle), the site having now reverted to jungle.

Karuwal Group.—The next morning an oily calm prevailed with current running from the north. We steamed south-east with the intention of examining the group of banks lying off Trichendur and of which the Velangu and Karai Karuwal Párs are the central and among the most important, having given fisheries more frequently during the past century than any other section of the pearl banks, with the single exception of the Tolayiram Pár †.

At 8 A.M. the four inspection boats were cast off to the south-west of the Velangu Karuwal Pár at a point due east of Trichendur Pagoda. The boats were ranged in line abreast, a quarter of a mile separating the individual boats and the coxswains were instructed to follow the steamer taking dives at regular and frequent intervals and preserving their respective distances apart. We then steamed three miles north by west and anchored on the west side of the Naduvu Malai Piditta Pár in $9\frac{1}{2}$ fathoms, the current still running strong from the north and the wind remaining southerly.

When the boats arrived, it was found that only the two on the west of the line had crossed over the párs, the others being too much to the east and traversing ground which was almost entirely bare sand. The results obtained showed the rock and sand to be of the same characters as the bottom on the Uti Pár region; in some places upon rocky ground a considerable amount of Orbitolites sand was found and in other places the sand was coarse enough to be considered a gravel. The fauna was in its main characteristic features similar to that of the Uti Pár—sponges were abundant and of similar species and, in addition, several specimens of the spherical crimson *Axinella tubulata* were obtained, containing the usual quota of commensals—Oligochaete worms and Gephyreans.

Of corals we found *Favia* sp. forming rounded masses 5 to 8 inches in diameter. The tubes of *Eunice tubifex* were again common together with *Pentaceros lincki*, *Antedon*, Ophiuroids and many Polyzoa, the most conspicuous of the lastnamed being dense hydroid-like colonies of *Scrupocellaria* sp. over 3 inches in height. Little seaweed was found but *Padina commersoni* was sometimes fairly common together with some bunches of *Codium tomentosum*. On Naduvu Malai Pár small nullipore balls (*Lithothamnion*) were locally abundant on certain of the sandy stretches. Pinna and live coral were absent from the ground examined this day.

The sandy ground to the west of the párs yielded numerous chanks and many valves of sand-loving Lamellibranchs (*Mactra*, etc.), the sand itself being of the usual brown calcareous nature, of fine grain and with comparatively little quartz.

A few living oysters were found on the Naduvu Malai Pár aged from $2\frac{1}{2}$ to 3 years together with many dead shells of about the same age, largely on sandy bottom. As in the Uti Pár region the majority of the shells were enveloped in a covering of sponge (*Clathria indica*).

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* "History of the discovery and conquest of India" translated by J. Stevens, 1695, and quoted in the Ceylon Monthly Literary Register, Volume III, N.S., p. 199.

† The Karuwa Párs were fished in 1805, 1815 and 1862.

The landmarks for the Karuwal Pár region are excellent. To the south Manapad lighthouse is conspicuous, due east is the lofty pile of Trichendur Pagoda while to the north-west is the white mosque near Kayalpattanam village and a Casuarina tope to the south of Pinnacoil, to say nothing of a white gabled Roman Catholic Chapel at or adjacent to Kayalpattanam point. Unfortunately the three latter are not marked upon the chart and as the Inspector was uncertain as to whether the tope is on an island or on the mainland and as to the exact relative positions of the chapel and the point named, the difficulties which I experienced in localizing the boundaries and positions of the párs were great and distracting.

From what I have seen already and from the silent evidence afforded by the charts on which the marks are either not placed or are indicated vaguely and without precision I am convinced that the work of inspection for years past has been carried out without that scrupulous exactitude necessary to obtain satisfactory and reliable results.

Inner Kudamuttu Pár Group.—This group, consisting of the Saith Kudamuttu, Kudamuttu, Rajavukku Sippi Sotichcha, Sandamaran Piditta, Pinnacoil Seltan and a few other small párs was examined on May 6th, the steamer accompanied by the four inspection boats, two on either side proceeding slowly from one end to the other, the divers descending to the bottom at regular intervals.

The ground upon the párs appeared less favourable to the maturing of pearl oysters than that of the Karuwal group. Competing organisms were in greater numbers and more luxuriant in growth; the banks were typically "dirty", using the term in the oysterman's sense of being pre-occupied by organisms, sponges especially, which give no opportunity to the well-being of oyster spat settling thereon.

A few old oysters apparently 2 to 2½ years old were found, less than half a dozen in number, together with some of a younger generation, 9 to 10 months old. The majority of both ages were, as usual, densely covered with sponge growth (*Clathria indica*). Dead shells of the younger generation were in quantity in some places. Death in many cases had been recent and the majority of these showed distinct signs of having been bitten, pieces having been snipped out of the ventral margin suggestive of damage by oyster-eating fishes, which were found notably numerous here, seven *Kilati* (*Balistes mitis*) being caught by the No. 4 boat which traversed the greatest extent of rocky bottom, while in the evening after anchoring, several large Vellamín (*Lethrinus* sp.), noted devourers of shell fish, were taken together with more Kilati.

Although we found no pearl oysters in quantity, the work of the boats showed that the ground to the east of this group and between it and the Sankuraiya Pattu Pár group is excellent chank ground and should be marked as a chank-bed on the chart. It will probably be found to extend also some distance northwards. The chank-bed sand was excellent of its kind—fine grained and very dark in colour, due to the presence of mud and organic particles and so forming an excellent feeding ground to the annelids which constitute the favourite food of the chank.

Seaweeds were common on these pars, principally *Padina* and the lamellar olive brown fucoid so characteristic of the Ceylon Periya Pár.

The characteristic fauna consists of—

Spongionella nigra, *Suberites inconstans*, *Clathria indica*, *Axinella tubulata* and *Siphonochalina* (with the usual commensals) as the most conspicuous and numerous sponges; a coarse form of the decalcifying sponge *Clione*, making burrows of large size, is also conspicuous in the blocks of dead corals occasionally met with.

Eunice tubifex, *Trophonia* and many small Polynoids and Serpulids, with Gephyreans and Nemertines.

Dromia sp., *Alpheus* sp., *Gebia* sp., *Squills* sp. and numerous other small Decapods.

Pentaceros lincki was present in quantity with an occcasional *Linckia miliaris*, and numerous *Antedon* spp. and Ophiuroids.

No *Pinna* was taken either on the sand or the rock.

Ascidians were scanty in number.

The pár is flat surfaced and in places discontinuous, varying from quartzose limestone to compact and extremely hard, brown, and purely calcareous rock. The loose fragments numerous in certain localities are either of the latter character or are masses of dead coral much tunnelled by boring molluscs and sponges. From the absence of live coral on these párs, I am of opinion that in common with the loose broken coral branches ("chullai or challai" as the Tamil divers term the latter) these fragments are derived from inshore reefs, of which a long one stretches northwards, parallel with the coast, from Tiruchendúr to Pinnacoil.

May 7th was spent in making traverses over the two groups of párs lying south-west of the Tolayiram Pár—an inner, which we may term the Puli Pundu group, and an outer, or Nenjurichchan group. The ground between and around was also examined.

Puli Pundu Group.—This collection of small párs, comprising the Kanna Puli Pundu Pár, Puli Pundu Pár, Saith Onpatu Par and Vada Onpatu Pár lie close together and agree in all essential characteristics, in the depth of water, which ranges from $7\frac{1}{2}$ to $8\frac{1}{2}$ fathoms, in the identity shown by the organisms found there, and in the physical nature of the rock forming the bottom. For the practical purposes of inspection and fishery they may be considered as a single unit. They agree exactly in all particulars with the párs forming the Uti Pár group, except that at the present examination no pearl oysters were found.

Nenjurichchan Group.—Very different are the banks which I propose to unite under the term Nenjurichchan group. The constituent banks are the Pár Kundanjan, Nenjurichchan and Mela Onpatu Párs with a depth ranging from $7\frac{3}{4}$ to $8\frac{1}{4}$ fathoms. These párs, although in almost the same depth of water as those of the Puli Pundu group, bear a fauna more characteristic of deep water conditions, *Gorgonia miniacea*, *Suberogorgia suberosa*, with numerous examples of *Juncella juncea* being characteristic. As usual, on these banks massive sponges are numerous, mostly dark coloured, and the rock, instead of being covered with ordinary sand, is sprinkled freely with large foraminifera (*Orbitolites* and *Heterostegina*); the rock is flat in surface and both in appearance and in fauna bears much resemblance to the seaward side of the Ceylon Muttuvaratu Pár.

Both to the west, the east, and the south-east of this group we have a great extent of sandy ground extremely rich in life, characterised by the presence of varied forms of Alcyonarians. Conspicuous among these last are a rosy tinted aborescent Pennatulid, a grey and drab *Pennatula* sp. and a slender *Virgularia* (*V. juncea*), the first named anchored by a branching root-like base, the two latter by a long and deeply embedded axis.

Equally characteristic is a stout lamellar and fan-shaped dark green Alga which passes below into a bulbous base embedded deeply in the sand; the projecting fan-shaped portion measures in many cases as much as 5 inches across; the bulbous base from 6 to 8 inches in length, stiffened by a large admixture of sand entangled among the ramifying filaments of the Alga.

That peculiar Ascidian, *Rhabdocynthia rosea*, is another characteristic organism.

Small crustaceans, molluscs and burrowing worms are also noteworthy, with a varying number of chanks.

After examining this region we proceeded N.N.W. from Pár Kundanjan Pár which brought us to the region immediately south-west of the Tolayiram Pár. Here we found considerable quantities of small oysters lying in clusters upon sand; the age appeared to be from three to four months and, besides the living, a considerable quantity of dead shells were found. A few of the latter showed signs of having been bored by carnivorous Gastropods and others were broken, possibly by the bites of some fish. This, however, is somewhat doubtful and the majority showed no apparent signs of what the cause of death had been.

The nuclei of the clusters were in the main the spicular Ascidian *Rhabdocynthia rosea;* in a few cases only was it a shell, a fragment of par or of dead coral. In many a nucleus was absent, the little oysters clinging to the shells of one another. Everywhere there was a marked scarcity of "cultch" (shells and rock fragments).

The sand was clean and in some places contained a larger proportion of quartz grains than at any other place hitherto examined. *Pennatula* sp. and *Virgularia juncea* were fairly common as was also the flat echinoid *Clypeaster humilis*. A few *Pentaceros lincki* and *Fungia dentata* were also met with.

From this position we went west, traversing the area indicated on the chart as a large chank bed. Here the sand became fine, dark in colour and slightly muddy. Zigzagging over this 16 dives were made, giving uniform results regarding the character of the sand and the organisms characterising it, numerous small chanks, small *Pinna* sp. and rooted fan-algæ.

Our supply of water was by this time almost exhausted; so, after completing the examination of this chank bed, the "Margarita" was headed for Tuticorin where we arrived the same afternoon.

The two next days I spent ashore in a further examination of records and in gathering local opinions, which I hold should never be treated with indifference. A mean has to be steered between the extremes of credulous faith and scornful contempt, and if the sifting be judicious the stories and opinions of fishermen and divers may often furnish useful hints of considerable importance in drawing deductions and in furnishing the necessary clue to elucidate some difficulty or apparent contradiction.

A study of the significance and origin of place names may also furnish considerable assistance, and the Jati Talaivamore, whose title is frequently rendered as Jati Talaivan, was fortunately able and willing to facilitate my task.

Under Captain Carlyon's kind guidance I was enabled also to examine the godown in which the chanks collected by divers on Government account are stored pending the periodical auction sale.

This store is situated about a mile north of the town at a spot conveniently near the shore, on land that once was a salt marsh.

The great majority of the shells were of medium size; quite a large number bore a cluster of young oysters, two to six months old, upon the upper whorls of the shell. In one case 14 young oysters had been so carried—a fact bespeaking both the abundance of oyster spat during the last six months and the poverty of resting places for the attachment of the spat at the end of the free-swimming stage.

Chanks of a size too small to be paid for, formed a heap of quite respectable dimensions.

The "Margarita" left Tuticorin on her second cruise at 7 A.M. on May 10th. The weather showed signs of impending change and on that account I was extremely anxious to ascertain at once the condition of the northern pars in order to compare with that of the southern groups with which I had now obtained a fairly satisfactory acquaintance. I decided therefore to devote this cruise to an examination of the banks between Kílakarai and Tuticorin.

CRUXIAN GROUP.—Of these banks the three southernmost, the Vantivu Arupagam Par, the Cruxian Par and the Cruxian Tundu Par, may conveniently be grouped together as the Cruxian group.

They have long been classed among the banks from which a fishery may from time to time be expected * and accordingly, although they cover a comparatively small area, I made a specially exhaustive examination first by a traverse from end to end by the four inspection boats strung out in line at quarter mile intervals as usual and upon the completion of this, by causing them to make four circles round the ship when at anchor upon the centre of the most important of the group—the Cruxian Pár itself.

At 8 A.M. a half knot current was running from the north, with wind from N.W.; temperature of water 89° F.; specific gravity 1,022·80.

Besides the work done by the divers in the boats who made in all 250 descents, a large number of check dives was made from the steamer. These, when compared with results obtained from the boats, showed the three pars to have a distinct and characteristic facies of their own, and pointed to the practical advisability of uniting the three under one head both on account of faunistic and of physical identity.

* The Cruxian group gave satisfactory results at the fishery of 1861.

The rocky ground was flat-surfaced and largely continuous; the sandy stretches found on and between the párs was never deep, scarcely ever exceeding a depth of 3 inches, and in consequence, individuals of the large species of Pinna, which is here characteristically abundant, are exposed for fully five-sixths of their length, only the apex being embedded in the sand. Quite a large proportion were dead shells.

Crowds of large Barnacles (*Balanus* sp.) and Zoophytes occupy the outer surfaces of the valves as well of the living as of the dead, the cavities of those barnacles that are dead harbouring great numbers of small crustaceans and worms.

A favourable feature of these pars is the absence of an excessive amount of sponges. Such as there were of the larger forms consisted principally of the massive *Suberites inconstans* and the cavernous *Siphonochalina communis*. In the former, besides the usual species of *Gebia*, were several of an interesting heteronereid form of *Nereis*. The tall, branched tubes of *Eunice tubifex* were met with wherever rock appeared on the surface.

A characteristic organism is a *Botrylloides* sp. which forms grey gristly-looking rounded masses of 3 to 4 inches in diameter. Algæ were scant in quantity.

The depth of the water over these pars shows great regularity, ranging within the limits of half a fathom, 6 to 6½ fathoms.

The only signs of pearl oysters consisted of occasional dead valves, old and much corroded and of an age which I would fix approximately at 2½ years. They had the appearance of having been dead several years.

A few chanks were found on the sand outside the eastern margin of the pars, where the sand is fine and largely calcareous in composition.

From 9–30 to 11–15 A.M. an oily calm prevailed, the surface of the sea covered as far as the eye could see with a brown scum composed of *Trichodesmium erythræum*. Its appearance and to some extent its effects were such as a thin film of oil produces when spread upon water.

We remained at anchor till the next morning near the middle of the Cruxian Par. A strong southerly swell prevailed the whole night and as a land wind blew with some force from the N.W. the ship rolled heavily making sleep practically impossible.

At 7 A.M. on May 11th we proceeded northwards after casting off the four inspection boats, which were ordered to examine the ground lying between the Cruxian Pár and the most southerly of the next group to be examined—the Marikan Pár group—and then to pass northwards over the whole extent of the latter pars.

The steamer led the way dropping a mark buoy on what was believed to be the south side of the Padutta Marikan Tundu Pár, as a guide to the following boats. We then headed north and anchored on the Devi Pár.

The boats reported continuous sand after passing the northern edge of the Cruxian Par, both between the two groups and along the line which should have led them over the Marikan Par group of banks—an unsatisfactory result due either to the plotting of the cross-bearings being incorrect or to the pars being incorrectly placed upon the chart. I incline to believe that the former explanation is the true one, seeing that the Inspector, although the shore-marks are distinct and clearly visible, has not the position of these marks indicated upon his chart. Rough and inexact work is the inevitable consequence.

VAIPAR KARAI PAR.—The next day, May 11th, after ascertaining that the ground in 6½ fathoms, two miles east of outer Chullai Island, consisted of fine sand mixed with a considerable amount of mud, we proceeded towards the south-east and anchored upon Vaipar Karai Par in 6¾ fathoms in order that I might make a descent in the diving dress.

When I alighted upon the bottom I found the water so turbid with suspended mud particles that it was impossible to ascertain what lay underfoot save by crawling on hands and knees, and even then I had to bring the helmet window within two inches of the ground. By so doing I found the bottom to be composed of fine calcareous sand commingled with a considerable proportion of muddy sediment. The surface was littered with numerous dead pearl oyster shells both entire and fragmentary, and

was underlaid at a depth of from 1 to 2 inches by flat-surfaced rock. On the least disturbance the mud constituents rose in dense clouds further obscuring vision. No recognisable reason for the death of pearl oysters could be traced; their average age was approximately 1½ year. Only a single individual was found alive; it appeared rather older than those that were dead, with the valves covered with a dense coating of tunicates, sponges and polyzoa; it had a distinctly stunted appearance. I also came across a considerable number of large *Pinna* lying prone on the surface, covered as in the case of those found the day previous, with quantities of large barnacles (*Balanus* sp.) together with a mantling of various species of Leptoclinids and several species of Zoophytes. Several massive corals of the kinds usually associated with pearl banks were noticed.

This bank, which is not marked upon the inspection chart dated 28th November 1892, by the bearing should lie between the Vaipar Periya Par and Pernandu Par as shown on that chart, but concerning this position there appears to be some doubt as the par-mandadai (native pilot) who accompanied us held that in reality it lies to the north-west of the Devi Pár.

From the character of the bottom such view is not unlikely to prove correct, for however carefully angular bearings be taken, the imperfections of the present working chart hinder them from being plotted thereon with accuracy. *

The Vaipar Karai Par is an exceptionally dirty and muddy bank, wholly different from the Cruxian Pár and associated banks. From what I saw and also from the history of the banks it appears, however, to be rather favourably situated for the deposit of spat and appears to be fitted to bear them till they reach from 1 to 1½ years old, after which age they rapidly die off. Such a bank would be a fitting one to utilize as a source from which to obtain young oysters were oyster transplantation ever to be attempted.

In the afternoon a heavy squall came on suddenly from the west-south-west, raising a heavy sea. The wind remained in the same quarter all night and the next morning the sea was so rough and the ship rolling so considerably as to render it impossible for me to make further diving descents. A native diver who went down reported the water too thick to permit him to see anything. After waiting a while in the hope that the weather would moderate, we proceeded to

Nalla Tanni Tivu, anchoring off the west shore. Here we landed soon after to verify, if possible, the presence of the oyster shells reported to us by the divers at Kilakarai. Much of the island consists of sand dunes overlaying a coral formation in which can be traced specimens of corals of the same species as those now living upon the adjoining and encircling reef. The island is farmed under the zamindari of Ramnad and several flourishing plantations of casuarina, cocoanut and palmyra were here found. We searched the sand dunes on the western side carefully and in several places we certified the presence of large quantities of pearl oyster valves, both entire and fragmentary; the nacre was undimmed in the case of many and even the mottled prismatic outer coating was intact in some, showing even the characteristic radiating purplish-brown bands distinctly. These shells certainly represent the remains of a fishery camp held here, when, it is impossible to say from anything in the outward appearance of the shells, as they might remain unchanged and uncorroded for an indefinite period when covered with sand in the comparatively dry climate of this locality.

The age of these shells when fished was, judging from the breadth of the hinge groove, not less than 4½ years, possibly five years.

There is no record of any fishery camp having been held here under British or Dutch control, and it has been suggested as probable that these shells on Nalla Tanni Tivu represent a fishery held by one of the Ramnad Rajas. This theory may, however, be dismissed at once as untenable, for we have no evidence that these local potentates ever claimed the right to fish pearl oysters in this district, though the zamindari does

* The compass bearings were difficult to fix owing to the heavy and continuous rolling of the ship. As near as they could be made out they were—

Hare Island Lighthouse, S. 57° W.
Church Gable, Tuticorin, S. 70° W.
North end, Chullai Island, N. 17° W.

maintain the right to rent out the local chank fishery at the present day ; while we have direct and overwhelming evidence that both the Portuguese and the Dutch, over a period of nearly three centuries, exercised the sole sovereignty over the whole of the pearl fisheries on both sides of the Gulf of Mannar.

The more probable explanation is that these shells represent the remains of a Portuguese pearl fishery camp located here *circa* 1560–1570, during the period when the Portuguese, at war with the Nayak, blockaded the Madura Coast and removed the Parawas from Tuticorin and Pinnacoil to settlements in the islands at the head of the Gulf of Mannar. This particular island of Nalla Tanni Tivu would be the natural location of a camp to serve a fishery off the Indian Coast under such circumstances, as it is the nearest one affording a satisfactory and sufficient fresh-water supply.

Nalla Tanni Tivu and Uppu Tanni Tivu Pars.—Early on the morning of May 13th we left our anchorage off Nalla Tanni Tivu and steamed south $2\frac{1}{2}$ miles to the south-west end of Uppu Tanni Tivu Par, where we cast off the four inspection boats with instructions to row E.N.E. over this bank. Several dives from the ship in five fathoms at this place showed the bottom to be flat rock with a considerable amount of sponge growing upon it. From this place we steamed to the eastern edge of Nalla Tanni Tivu Par and there awaited the arrival of the inspection boats.

The results showed that the interval of sandy bottom between these Pars as shown in the inspection chart is largely absent; that the extent of hard bottom is more extensive than is charted, and that special attention should be given to this region at inspections, especially in view of the remains of old shells on the neighbouring island of Nalla Tanni Tivu. The depth of water on Uppu Tanni Tivu Par varies from $4\frac{1}{4}$ to 6 fathoms, while that on Nalla Tanni Tivu Par ranges from $5\frac{1}{2}$ to 7 fathoms, depths rather greater than those recorded on the inspection chart.

The rock on both Pars varies from an almost pure limestone to a calcareous sandstone, in the former case brownish yellow in colouring and ringing like iron under a blow; this I consider the bed rock of the plateau and not a recent calcrete. It is apparently identical with the hard limestone of the Jaffna Peninsula of Ceylon.

Few specimens were obtained as the water was too clouded with mud to permit of objects being seen upon the bottom. The divers complained bitterly of the discomfort of these conditions under which they had to examine the bottom by touch alone.

This excessive turbidity is in itself quite sufficient to entail upon pearl oysters starvation, weakness and eventual death, especially in the case of young and immature ones. A similar condition entailing fatal results I noticed among the younger oysters which I kept in aquarium tanks at Galle during the south-west monsoon when discoloured turbid water is the prevailing condition in Galle Harbour.

My coxswains, who have been connected with Ceylon inspections for a very long period, 12 to 19 years, state that while the water becomes discoloured on the Ceylon side after a continuance of heavy weather the extent of turbidity is slight compared with what they have seen on this side during the last two days.

On the rocky ground of this region the tubes of *Eunice tubifex* were plentiful together with many sponges and gorgonoids.

Siphonochalina communis, *Axinella donnani*, *A. tubulata*, *Isodictya* sp., *Suberites inconstans*, &c., were met with, also *Juncella juncea* (in quantity) and *Gorgonia miniacea.*

Neither chanks nor *Pinna* were found.

The sand met with was, as usual on this coast, fine grained and largely calcareous, made up in the main of minutely comminuted shells. The quartz grains present were all extremely minute ; foraminifera were fairly abundant.

In the afternoon as wind and sea increased rapidly we ran for shelter to the north-east side of Uppu Tanni Tivu. By 4 P.M. a very nasty cross sea got up and with the wind blowing half a gale the ship rolled unpleasantly at her anchorage. Towards sunset a strong land wind set in, the sky over the land murky-red and threatening.

In the morning (May 14th) the landward side of the vessel, and of the awnings, funnel, stanchions, &c., was covered with a thick coating of impalpable red dust ; the murkiness over the land of the preceding night had been due to dust clouds, which, as they prevail throughout the south-west monsoon on this coast, must therefore form no inconsiderable factor in the production of muddy deposits in the sea.

Kumulam Par.—Leaving the Uppu Tanni Tivu anchorage at 6–20 A.M. we steamed south to the small Kumulam Par. A series of dives here in six fathoms showed the bottom to be rocky, sometimes fairly clear of sand, at other times covered with from one to two inches. A few Holothurians and sponge fragments were brought up; no trace of oysters was found.

Steaming a quarter of a mile further another series of dives gave similar results; flat rock with sand filling the depressions and with occasional small, loose fragments of calcrete upon the surface.

At both stations the sand contained a large proportion of mud, so much that I have no hesitation in condemning this ground as hopeless and utterly unfit to rear oysters to maturity. It may with safety be ignored in future inspections.

The ground lying between the Kumulam and Vembar Periya Pars was next examined and found to consist of a coarser sand than any seen so far. Many medium sized quartz grains were present and though the water here was discoloured, no mud was actually found in the sand.

Depth 10 fathoms. Temperature of sea at 4–30 P.M. 89° F. Specific gravity 1,022·80.

Vembar Periya Par.—Continuing our course we arrived at 8–15 A.M. at a point which Captain Carlyon believed to be the north-east end of the Vembar Periya Par.

The steamer and the four inspection boats were employed in the examination of it for the rest of the morning.

This par as outlined on the chart is of considerable extent, 3 miles in length by $1\frac{1}{2}$ mile in breadth, the bank ranking next in size to the Tolayiram Par. The depth shown on the chart is 6 to 7 fathoms.

The examination proved hardly satisfactory, as out of upwards of 160 dives taken over an area of three miles long by one mile broad, but eight dives (in 8 fathoms) were on rock. All the soundings were between $6\frac{1}{2}$ and 9 fathoms, the great majority being 8 to $8\frac{1}{2}$ fathoms.

On the small patch of rock found by No. 2 boat two small pearl oysters—4 to 5 months old—were discovered, together with a large number of Suran (*Modiola barbata*). One small fragment of rock bore a densely packed cluster of 10 individuals. Euncid tubes and zoophytes were also present in considerable abundance.

The greater part of the sand was of a character approximating closely to that found on the Ceylon banks—bright clean yellow in general colour with plenty of quartz, cleaner and better sand even than that taken between this region and the Kumulam Par. Two dives gave tenacious black mud similar to that taken between Uppu Tanni Tivu and Nalla Tanni Tivu Pars.

The Par is all a more or less pure limestone, mostly of fine grain.

Viewed by the nature of the bottom and the depth of water, I am very doubtful if the locality inspected is the Vembar Periya Par; I believe the ground examined in reality lies seaward of the Par so named. This Vembar Periya bank at all times must be difficult to find from want of good land-marks; there are indeed no charted land-marks observable from this position at sea, though several remarkable trees and clumps can be seen and might be utilized for lack of something better. To do this sketches of the relative positions of these trees and clumps should be made from different bearings and the positions of the principal objects marked accurately on the chart.

Fortunately this is the only bank in any way difficult to locate, all others that are equally far from land being within sight of such conspicuous land-marks as beacons, lighthouses and pagodas.

On the evening of May 14th we returned to Tuticorin, the unsettled and threatening character of the weather making it doubtful if we should be able to do any further work at sea.

Pending a decision upon this question, I occupied part of this stay ashore in endeavouring to locate any bed of window-pane oyster (*Placuna placenta*) that there might be in the neighbourhood. I had found prior to this several young individuals

thrown up by the tide along the shore to the south of the town, and from the muddy character of the bottom I thought it useful to investigate further. Accordingly taking two fishermen I proceeded south along the coast and passed the salt factory scrutinizing as we proceeded the eroded edge of the low sandy land on the one side and the face of the littoral on the other. Along the shore of the bay-like estuary south of the salt factory large quantities of dead *Placuna* shells are observable in two places accumulated in dense masses and embedded in the sand some little distance below high-water mark. The shells appear as densely packed as those in the great heaps which mark the sites of former fisheries of this shell-fish along the shores of Lake Tampalakam near Trincomalie in Ceylon.

Close by I saw others embedded in the adjacent sand hummocks, showing up wherever a section was exposed. In some places a depth of sand of fully 18 inches lay upon the shells. Meanwhile the fishermen had been wading about in the shallows and after trying various places found a small bed of the living animal and brought ashore a considerable number. The majority of them were fairly well grown and approaching maturity. The size of six typical individuals averaged $15\frac{1}{2}$ centimetres in diameter, being almost perfectly circular in outline.

The men also reported large numbers of dead shells which, however, probably belonged to past generations.

Placuna lives well out of water if kept in a cool situation, a property due to the faculty this shell-fish possesses of closing the valves tightly at all points round the margin, after the fashion of the edible oyster. In this particular case, several individuals which I put on one side for this experiment were found alive and vigorous thirty hours later, in spite of being drained of water and the temperature as high as 96° F. in the shade.

In Ceylon a fishery of this shell was frequently leased by Government with considerable profit during the past century, the locality being an extensive shallow muddy bay on the north-east coast, close to the harbour of Trincomalie.

In Tuticorin I could glean no information as to whether a fishery had ever been held in the neighbourhood; in view of the presence of living individuals and of the great piles of embedded shells along the sea-shore it might prove to be of advantange to Government if further search were made in suitable localities—backwaters, shallow estuaries, etc.—along the coast of the Madras Presidency with a view to locate any beds sufficiently large to provide a fishery and to ascertain also if pearls be sufficiently numerous to make such a fishery profitable. I notice that Dr. Edgar Thurston * records *Placuna* from Pulicat lake and Buckingham canal. The former of these has, I understand, an area far exceeding that of Tampalakam Bay and should therefore receive special attention.

The weather had now improved temporarily and it was decided to spend two more days upon the banks, in order if possible to provide me with an opportunity to make a diving descent upon the Tolayiram Par, a matter which I considered to be of great importance.

Leaving Tuticorin on the morning of May 17th, we proceeded to a position south-west of Mela Onpatu Par, where we spent the whole of the available time in taking numerous hauls of the dredge in $9\frac{1}{2}$ to 10 fathoms. My intention had been to select a locality which was a known chank bed in order to experiment with the dredge. I had accordingly requested Captain Carlyon to arrange to be taken to a suitable bank, the consequence being that the pilotage of the steamer was entrusted to a Parmandadai, who was, I understand, informed of my wish in the matter. The results showed that he deliberately placed the ship where I am absolutely convinced no chank bed exists.

This action, accidental or intentional, barred my way to demonstrate, as I had wished, the utility of the dredge in fishing for chanks. Fortunately one of the pearl banks fished in February 1905, on the Ceylon side, adjoins a chank bed, and having

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* "Notes on the Pearl and Chank fisheries and Marine Fauna of the Gulf of Manaar," Madras, 1890, page 27.

the use of the dredging steamer "*Violet*" at that time, I was able to satisfy myself by actual experiment that the dredge is an efficient implement for successful chank fishing.

The bottom where the Parmandadai took the "Margarita" was quite unlike that of any of the undoubted chank beds we had previously visited, while the depth of water, almost ten fathoms, was nearly double that upon typical chank beds.

The ground was extremely rich in life, elongated cylindrical actinians of two species were abundant embedded in the sand, together with large numbers of an elongated Molgulid, which appears to live upright with the aboral extremity implanted in the sand. A small *Flabellum sp.* was plentiful on the surface together with a drab and grey *Pennatula* and many *Virgularia juncea ;* æborescent rosy tipped Pennatulids were also characteristic, while several specimens of a hollow-stemmed coarsely-branched Alcyonarian (? *Siphonogorgia sp.*) were taken. The latter were pink and white in colour and were accompanied in each case by a pair of small crabs and a pair of small Galatheids similarly coloured and obviously commensals.

Some colonies were more uniformly suffused pink than others and on these the commensals were more uniformly tinted pink. On one colony, where white colouring largely prevailed, and where the margins of the branches alone were coloured pink, the crabs were uniformly white except for two splashes of pale pink on the anterior edge of the carapace. The large fan-shaped green alga with bulbous base embedded in the sand was the only alga found. A single specimen of *Lingula sp.* was one of the noteworthy acquisitions made in this locality.

The sand was fine, clean, and with no trace of the mud which is a characteristic component and essential attribute of a prolific chank bed.

Hence we moved north to the Tolayiram Par, where we anchored after verifying the locality by cross bearings and by some trial dives, which indicated the presence of numerous young oysters.

During the evening the crew caught a large number of trigger fishes (*Balistes*) and of strong-toothed fishes of the genus *Lethrinus*, the latter being known as Vellamīn * among the Tamil fishers. The stomach contents of the *Balistes* were in this case free from incriminatory evidence in respect to pearl oysters, due probably to the fact that all the individuals were of a small size. In the case of the Vellamīn on the contrary the stomachs were crammed with fragments of pearl oyster shells upon which this fish appeared to be feeding exclusively. As six of these, all of large size, were caught within two hours it is plain that these fish are now inflicting enormous havoc upon the bed of oysters on this par.

The next morning I donned the diving dress, and the water being fairly clear I had an excellent opportunity of examining the bank.

The depth where the descent was made is $9\frac{1}{2}$ fathoms. I found the bottom very variable; in most places a covering of about an inch and-a-half of sand lay upon flat surfaced rock. Here and there the rock protrudes or lies level with the general sandy surface. These exposed patches are small in area, usually from $1\frac{1}{2}$ to 2 feet in diameter. A limited amount of small cultch is present on the surface to which the majority of the oysters adhered. The cultch consists of short fragments of much worn branches of coral ("chullai"), quite small Nullipore balls (*Lithothamnion*), the tests of dead echinoids (chiefly of *Clypeaster humilis*), fragments of calcrete and such like.

The oysters were fairly abundant, their numbers obviously curtailed by the quantative limitation of the cultch. They appeared to be of two generations, the one four to five months, the other ranging from six weeks to two months.

Sponges were not obtrusive, several specimens of the peculiarly massive *Petrosia testudinaria* were seen but the commonest species was one which interiorly is yellow, while the exterior is more or less tinted with pale green. In its growth it envelopes much sand in its substance, which is generally level with the sand surface, sending up stout tapering branches at intervals. Its general appearance is inconspicuous.

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* *Lethrinus nebulosus* and other species.

No living coral was seen except a small *Favia sp.* and an occasional Gorgonid.

While on the bottom I saw many fishes including both *Kilati* (Trigger fishes) and *Vellamīn* together with a beautifully striped sponge-eating fish (*Holocanthus imperator*). The Asterid, *Pentaceros lincki*, was not abundant. No Suran (*Modiola barbata*) was seen.

After I had completed my examination of the bottom, Captain Carlyon being of opinion that it was now too late in the season to do further work, and as the coal supply was on the point of giving out, under the circumstances I determined to bring the investigation to a close.

When the anchor was brought up we had a repetition of our former experience on this bank—the chain being studded with young oysters of about two months old affixed by their byssal cables near the attachment to the anchor.

Two hours later we landed for the last time at Tuticorin and although I had not been able to examine every bank charted, I considered that I now knew the general characteristics of the principal groups sufficiently well to answer all practical purposes and enable me to furnish solutions to the majority of the problems I had set out to solve.

V.

COMPARISON OF THE CHARACTERISTICS AND RELATIVE IMPORTANCE OF THE VARIOUS PEARL BANKS.

In the present section an attempt is made to sieze upon the essentially characteristic features of the chief pars—historical, topographical, physical and biological—and therefrom by comparison with one another and with typical banks on the Ceylon side to evolve a knowledge of their relative economic importance in regard to the prospect they respectively hold out of successfully maturing such oyster spat as may from time to time settle thereon. Such a comparative survey will also go some distance towards enabling us to say what direction any measures of cultivation should take, if it be found advisable or possible to assist nature by artificial means.

The configuration of the Indian coast of the Gulf of Mannar is simpler than that on the Ceylon side. On the former there is no great shoal like that of the Ceylon Karativu, which stretches northwards into the sea for a distance of nine miles giving a certain amount of shelter to a great area of varied bottom, rock and sand, lying in the Bay of Kondachchi. On the contrary the Indian Pearl Banks lie open to the full force of the south-west monsoon which on this coast sweeps up in great violence from south to north. Again lying as they do on the west side of the Gulf, they also experience much rough weather during the north-east monsoon, a time when the Ceylon banks, lying under the lee of the land, enjoy comparative quietude. The period of immunity from storm disturbance on the Indian coast is accordingly greatly curtailed and is restricted under normal conditions to the months of February, March and April. Occasionally fairly quiet conditions prevail during the greater part of May—the onset of the south-west monsoon in full force being experienced somewhat more tardily there than on the Ceylon side.

This geographical disability of the Indian Banks is linked with and intensified by the mechanical disadvantage entailed by the inferior character of the sand on that side, its finer grain and the admixture with it of mud—characteristics which contribute to increase greatly the turbidity of the water whenever heavy seas sweep the Pearl Bank region. As already noted these are conditions which have probably become intensified concurrently with the erosion of the southern extremity of India and which tend, though with extreme slowness, in the historic sense, to reduce the pearl oyster productiveness of this locality—deductions from which we infer greater prosperity in times past. That there was such anterior prosperity we have indications in the existence of remains of ancient oyster-shell heaps close to Cape Comorin, in the frequent allusions of classical writers to the wealth of the Pearl Fisheries of Kolkoi, which town we have seen was situated on the river Tambraparni, in the statement of Friar Jordanus that as many as 8,000 boats were engaged about the year 1330 in the Indian and Ceylon fisheries and in the fact that Kayal or Cail near Pinnacoil is spoken of by Marco Polo, Ludovico de Vathema, Barbosa and other mediæval travellers as the head-quarters of the Pearl Fishery—a "great and noble city inhabited by jewellers who trade in pearls."

Dealing with the conditions as they are at present, we find that so far as our available modern records permit us to judge, all the known oyster-productive banks are comprised in the division which I have termed the Central, lying between Vaipar and Manapad point, a distance roughly of 40 miles.

A list of these banks and of the groups into which I propose to classify them has been given above on pages 25 and 26.

It now remains to describe the varying characteristics of each group and to institute comparisons as detailed as the material at our command will allow.

1. Tolayiram Group.

This group possesses the distinction of being the most productive and remunerative collection of pārs along the Tinnevelly coast. Two banks only are comprised

under the group title—the large Tolayiram Pár and the small Kutadiar Pár. The former is by far the largest of the productive párs; the latter, which lies to the south-west extremity of its huge neighbour, being on the contrary one of the smallest, an oval-outlined rocky patch one mile long by half that in breadth.

The Tolayiram Pár lies 8 to 11 miles off the coast and opposite Hare island and Tuticorin Bay, the northern extremity due east from the town of Tuticorin. In shape the bank is roughly crescentic, the concave side turned shorewards. Its long axis lies roughly north-east by south-west measuring over six miles in this direction. The width varies from one to two miles, broadening as we approach the upper extremity. The depth of water over it ranges from 8 to 11 fathoms.

Eight fisheries have taken place upon this locality during the past 120 years, namely, in 1784, 1787, 1807, 1810, 1822, 1830, 1889 and 1890.

The annexed table shows the results of these fisheries so far as I can obtain particulars:—

Year.	Number of oysters fished.	Gross Government revenue.	Net Government revenue.
		RS.	RS.
1784	....	42,420	42,420
1787	....	63,000	63,000
1807	71,647,305	2,91,539	....
1810	More than 22,000,000	2,38,897	....
1822	....	1,55,693	....
1830	....	Separate revenue not given.	....
1889	12,600,531	1,89,984	1,58,483
1890	1,806,762	25,061	7,803
	Total revenue over	Rs. 10,06,594	

The name Tolayiram Pár, literally "900 banks", pithily describes the peculiar physical conditions which prevail over the area so denominated. The character of the bottom is an alternation of rocky patches scattered irregularly in a vast setting of sand.

The sizes of the outcrops of rock differ greatly, from little tabular fragments a foot or two across to great areas of several acres in extent. The sand is nowhere deep, seldom forming a layer of more than six inches in depth, filling up inequalities in the rocky framework of the bank.

The rock is a fine grained limestone compact and resonant, the colour yellowish brown. Here and there a small admixture of quartz is present but never in any large proportion. Loose blocks and many parts of the exposed surfaces are in a "rotten" condition, tunnelled and excavated by boring molluscs and occasionally by *Clione.*

The character of the sand is fine grained and almost entirely calcareous—a similar material to that from which the underlying rock has originated.

Cultch is fairly abundant in places, scattered over the sand. It consists of dead shells, broken branches of Madrepore coral ("chullai"), Echinoid tests and similar material.

A striking parallelism can be traced in nearly every characteristic between this bank and the well known Periya Pár on the Ceylon side of the Gulf of Mannar. In both cases the bottom consists of a few inches of sand covering flat rock in those places where the rock does not outcrop and with a fair amount of small cultch scattered over the sand.

The average depth, 9½ to 10 and 11 fathoms, is the same in both; both are situated further seaward than any other true oyster párs on their respective sides—the Periya Pár 16 to 18 miles off land, the Tolayiram Pár 11 to 12 miles.

The faunistic characters approximate in a remarkable manner, the larger and more conspicuous species of animals are the same in both localities.

In the sponge, coral, echinoderm, molluscan and fish fauna there is practical identity. One list will serve for both.

Thus we have as common to each :—

Petrosia testudinaria, Spongionella nigra, and Axinella donnani typifying the sponges ; the abundance on these two banks of *Petrosia* is one of the most remarkable of the many of the striking resemblances between these banks, for this sponge, striking in its strangely massive form, may be said to be limited to them. I have scarcely ever seen it elsewhere.

Corals are scarce on both banks, represented by isolated colonies of Astraeids (*Favia sp.*) and of *Meandrina.*

Occasional Alcyonarians and Pennatulids are found together with numbers of knobbed horse chanks and small lamellibranchs of identical species. *Pentaceros linki, Linkia laevigata* and *Antedon sp.* are the chief starfishes on the Tolayiram Pár.

On both banks the fish population as represented by the trigger fishes (*Kilati*), and Vellamin (*Lethrinus spp.*) and gobies, appears to be greater in numbers than on the banks nearer the shore.

On the whole both banks are decidedly poor faunistically, with little diversity of life-forms which in the majority of cases are also poor numerically. The absence of Madrepores, of *Pinna* and of the tubes of *Eunice tubifex*, is characteristic and note-worthy.

The Periya Pár is cited by Professor Herdman * as especially suitable for dredging over. The Tolayiram Pár is equally so, or if anything somewhat superior as the rocky surface is quite free from upstanding growths or rugged inequalities.

Reviewing the history of the Telayiram Pár as shown by the Inspection diaries dating from 1860, we find that subsequent to the year named—when the bank was covered with oysters said to be $3\frac{1}{2}$ years old—there are records of the bank having been stocked extensively with spat four times, one of which resulted in the fisheries of 1889 and 1890.

The particulars of these are—

1863. " Some young oysters ". (It would appear that the numbers could not have been large. " *Suran* " was noted as present the same year).
1874. " Some young oysters on Kuthadiar Pár with ' *Suran* '. "
1878. " Thickly stocked with oysters of one year age."
1881. " Some oysters of one year."
1884. The Inspection summary reads "plenty of oysters of one year age; clean and healthy." These oysters survived and furdished the two successive fisheries of 1889 and 1890, at which a total of 14,407,293 oysters were fished.
1904. Since 1890 only one spat fall has been recorded—that found during the present year's examination.

The bank was not examined in the spring of 1861, nor in 1862, 1864, 1868, 1870, 1874, 1893 and 1900.

From the above we observe that out of a total of 44 years, 1860—1904, there have been five *recorded* spat falls on this bank with the probability of a sixth in 1874, when this bank was not examined although the adjeining Kuthadiar Pár bore young.

The bank brought one lot of these—that of 1884—to maturity and from what I can see the prospects of a fishery resulting from the present population of young oysters are good if they survive till next spring. By that time they will be too large to suffer much from the depredations of oyster-eating fish (Trigger-fishes and Vellamin). They will then be more robust and better fitted to endure the discomforts and danger of starvation, which are the concomitants of the disturbed water conditions during the stormy period of the year.

Comparing the history of the Periya Pár, we find that in 26 years ending 1904, this bank was restocked at least 12 times without yielding a fishery. We know also that one fishery, that of 1879, is the only one yielded by this bank during the past century (7,645,901 oysters realizing Rs. 95,694).

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* *loc. cit*, Pt. 1, page 111.

So while the Ceylon bank is infinitely more fertile in the number of times it is replenished with oyster spat, its Indian counterpart has greater reliability; six times do we know that it has brought its oysters to fishing maturity, namely, in 1784, 1787, 1807, 1810, 1822 and 1889–1890, and very probably a third time as well, for the oysters noted in 1860 as $3\frac{1}{2}$ years old were in all probability there in 1861, in the spring of which no examination was made, the officers in charge being busy with the fishing of oysters of a similar age on the inshore párs. This divergence in results is due in great part to the Ceylon bank being situated in a relatively more exposed position being close to the edge of the precipitous submarine cliff that margins the seaward aspect of the Ceylon Pearl Bank plateau. As a consequence the heavy seas which characterise the period of the south-west monsoon break in unmitigated violence upon the Periya Pár, whereas on the Indian coast the movement of the water during the same season has undergone considerable amelioration when it reaches the Tolayiram Pár from travelling over a couple of hundred miles of comparatively shallow water.

Faunistic and many physical (chiefly geological) characteristics link the Tolayiram with the Periya Pár; but in regard to the aspect and degree in which the former meets the fury of the south-west monsoon, its position is more comparable with that of the Cheval Pár which lies on the leeward side of the Periya Pár, and is as consistently reliable as the latter is the converse.

The value of the Tolayiram Pár may be assessed as midway between the Cheval Pár and the Periya Pár, inferior to the latter chiefly by reason of oyster spat being less abundant and to current conditions (surface-drift) being less favourable to the deposit of such spat on the Indian than the Ceylon side;—partly also to the conditions of life being somewhat less favourable on the Tolayiram Pár owing to the greater amount of sediment present in the sea on the Indian side.

The data for the institution of comparison between the rate of growth normally characteristic of the Tolayiram Pár oysters with that of oysters from typical localities on the Ceylon side rests upon a single series of measurements and weights of that generation of the former that survived to a fishable age in 1889. The resultant comparisons based upon these dimensions are highly instructive and while in my opinion I believe it is probable that they are quite typical of the normal progress of growth of oysters on this pár, further series of growth observations are desirable and Inspectors after this should be instructed to record the necessary particulars on every available opportunity.

Two methods of comparison are available: (*a*) the external dimensions of the oysters when alive, and (*b*) the weight of the cleaned shells.

Making use of the former method we find usually but little increase in the length and depth of the shell after the third year; the shell secreting energy of the animals being thereafter occupied chiefly in adding to the thickness of the valves.

I now attach greater importance to observations upon the average weight of oyster shells than upon measurements of length and depth, increase being nearly as steadily progressive in old age in the case of weight of shell as it is during the first three years of existence; it furnishes us with the most reliable guide available in the assessment of age that I know of.

But we need to have considerable knowledge of the special growth peculiarities of the ground we deal with. Some párs by reason of abundant food supply hasten the growth of their oysters to a surprising degree, while others where less favourable conditions prevail bear oysters of an unhealthy appearance and of stunted size.

On the Ceylon side two distinct types of oysters are found, the one large and vigorous, peculiar to the Southern and Eastern Cheval and Moderagam Párs, the other slow-growing, small and stunted, characteristic of the rocky banks of the Muttuvaratu, Mid-West and North-West Cheval.

We will now proceed to compare the sizes and weights of the generation of oysters carefully guarded on the Tolayiram Pár by Captain Phipps from 1884 to 1889 with those of oysters of the two types referred to on the Ceylon side.

Weight of Pearl Oyster Shells.

Locality.	Date.	Age.	Number weighed.	Weight per 100 pairs of values.	Increase in weight in year preceding.
		YEAR.	PAIRS.	OUNCES.	OUNCES.
Tolayiram Pár..	March 1884	$\frac{3}{4}$	10	1·00	..
	October 1884	$1\frac{1}{3}$	10	3·75	..
	March 1885	$1\frac{3}{4}$	10	6·25	5·25
	October 1885	$2\frac{1}{3}$	10	7·00	3·25
	April 1886	$2\frac{3}{4}$	10	7·50	1·25
	November 1886	$3\frac{1}{3}$	10	8·50	1·50
	March 1887	$3\frac{3}{4}$	10	10·75	3·25
	October 1887	$4\frac{1}{3}$	10	13·00	4·50
	November 1888	$5\frac{1}{3}$	10	15·25	2·25
	(Fished) March 1889	$5\frac{3}{4}$	10	16·62	..
	,, ,, 1890	$6\frac{3}{4}$	3	17·64	1·02
Western Cheval Pár * (Type intermediate between the freely grown oysters of the South and South-East Cheval and the extremely stunted ones from the Muttuvaratu).	March 1871	$\frac{3}{4}$	13	2·50	..
	,, 1872	$1\frac{3}{4}$	13	7·50	5·00
	,, 1873	$2\frac{3}{4}$	50	11·88	4·33
	November 1873	$3\frac{1}{2}$	100	12·81	..
	(Fished) March 1874	$3\frac{3}{4}$	45	15·31	4·43
	,, ,, 1875	$4\frac{3}{4}$	47	18·75	3·44
South-East Cheval Pár * .. (Free growth type)	March 1874	$\frac{3}{4}$	33	2·25	..
	,, 1875	$1\frac{3}{4}$	60	8·50	6·25
	,, 1876	$2\frac{3}{4}$	150	13·44	3·94
	,, 1877	$3\frac{3}{4}$	51	18·75	5·31

* In Captain Donnan's table the ages of these are given as three months older than shown here; the figures now given, I believe, approximate more closely to the actual ages.

Analysing the above table we obtain the following comparisons:—

Tolayiram Pár.

		oz.
Weight at	$\frac{3}{4}$ year	1·00
,,	$1\frac{3}{4}$ years	6·25
,,	$2\frac{3}{4}$,, ...	7·50
,,	$3\frac{3}{4}$,, ...	10·75
,,	$4\frac{1}{3}$,, ...	13·00
,,	$5\frac{3}{4}$,, ...	16·62

North-West Cheval Pár.

Weight at	$\frac{3}{4}$ year	2·50
,,	$1\frac{3}{4}$ years	7·50
,,	$2\frac{3}{4}$,, ...	11·88
,,	$3\frac{3}{4}$,, ...	15·31
,,	$4\frac{3}{4}$,, ...	18·75

South-West Cheval Pár.

Weight at	$\frac{3}{4}$ year	2·25
,,	$1\frac{3}{4}$ years	8·50
,,	$2\frac{3}{4}$,, ...	13·44
,,	$3\frac{3}{4}$,, ...	18·75
,,	$4\frac{3}{4}$,, ...	...

The weight of three typical oysters from the fishery held on the Muttuvaratu Pár in 1891 is 5·375 ounces, equivalent to a weight of 17·916 ounces per 10 pairs of shells when the oysters were approximately $6\frac{1}{2}$ years old.

The annual increase in weight of oysters on the Tolayiram Pár compares, as will be seen from the above, very unfavourably with the comparatively stunted oysters characteristic of the Western Cheval. The nearest approximation was at the age of $1\frac{3}{4}$ year, when 10 Tolayiram Pár oysters weighing $6\frac{1}{4}$ ounces were but $1\frac{1}{4}$ ounce less than the weight of a similar number from the North-Western Cheval. During the next twelve months, however, the latter gained $4\frac{1}{2}$ ounces as against an increase of

$1\frac{1}{4}$ ounce by the former. This disparity continued toincrease more slowly thereafter, but unfortunately for want of data we cannot give the exact amount for the age of $4\frac{3}{4}$ years.

It is a pity that we have not available a record of the yearly weight increase of the oysters fished on the Ceylon Muttuvaratu Pár in the same years as those of the Tolayiram Pár. If we had I think we should find that there would be shown close approximation between the two; the Muttuvaratu oysters of that generation were markedly stunted and poor and the fishery of 1889 was decided upon only after considerable hesitation.

The only datum I possess is the weight given above of three typical oysters from the 1891 fishery. This which is equivalent to a weight of 17·916 ounces for 10 shells at $6\frac{1}{2}$ years of age as against 17·64 ounces for a similar number of $6\frac{3}{4}$ years old oysters from the Tolayiram Pár in 1890 indicates practical identity in growth-rate.

By the courtesy of Captain Carlyon I have been enabled to measure a few individuals of this last fished generation of Tolayiram Pár oysters and append a table thereof in which the measurements of some of the oysters from the Muttuvaratu Pár are included for the sake of comparison. The numbers are too restricted to give an average that may be taken as thoroughly trustworthy. They constitute, however, the only data available and till systematic records extending over a considerable series of years be obtained by work in the future it is well to place them on record :—

Date.	Age.	Size.	Average.
March 1885	$1\frac{3}{4}$ years	40 × 64 × 23 Millimetres .. 60 × 53 × $22\frac{1}{2}$,, ..	65 × 58·5 × 22·75
April 1886	$2\frac{3}{4}$ years	62 × 58 × $23\frac{1}{2}$,, .. 63 × 58 × $27\frac{1}{2}$,, .. 67 × 64 × 31 ,, .. 62 × 62 × 30 ,, ..	63·5 × 70·5 × 27·5.
October 1887	$4\frac{1}{3}$ years	71 × 70 × 32 ,, .. 79 × 70 × 32 ,, .. 80 × 74 × 35 ,, ..	76·66 × 71·33 × 33.
November 1888	$5\frac{1}{3}$ years	77 × 80 × 32 ,, .. 78 × 78 × 33 ,, .. 78 × 74 × $33\frac{1}{2}$,, ..	76·66 × 77·33 × 32·83.
March 1889	$5\frac{3}{4}$ years	78 × 80 × 33 ,, .. 80 × 74 × 31 ,, ..	79 × 77 × 31·33.
,, 1890	$6\frac{3}{4}$ years	72 × 68 × 31 ,, .. 70 × 73 × 34 ,, .. 76 × 72 × $31\frac{1}{2}$,, ..	72·66 × 71 × 32·16.
		Muttuvaratu Pár, Ceylon.	
March 1891	$6\frac{1}{2}$ years (deep short oysters covered with living growths—Lithothamnion and corals; much corroded by the tunnelling of *Clione*).	73 × 63 × 36 Millimetres .. 67 × 57 × $35\frac{1}{2}$,, .. 80 × 58 × 36 ,, ..	73·33 × 59·33 × 35·83.

It would appear from the preceding tables that the growth of the Indian oysters is distinctly retarded after the third year, the life conditions being more favourable to the young than to the old—a condition which I believe will be found due largely to the great abundance of encrusting organisms, sponges and polyzoa especially, which begin to flourish upon the valves of the Indian oysters in wonderful abundance from the age of $1\frac{1}{2}$ year. A similar state of marked retardation in growth is characteristic of the oysters from the Ceylon South Moderagam Pár, after the attainment of the same age, a retardation coincident with the appearance of luxuriant sponge, tunicate, and polyzoa growth upon the valves. On the South Cheval where such commensal growth is rare, no such marked slackening in the rate of growth is apparent.*

The oysters of the Tolayiram Pár in October 1887, when $4\frac{1}{3}$ years old, gave a pearl valuation of but Rs. 3–11–5 per 1,000 and as this was much too low to justify a profitable fishery, it was not till after the valuation of November 1888, affording a valuation of Rs. 13–12–8 per 1,000, that a fishery was decided upon. The oysters were therefore $5\frac{3}{4}$ years old when first fished in 1889.

* See my "Report on the Biological results of the Ceylon Pearl Oyster Fishery of 1904", Ceylon Marine Biological Reports, No. 1, Colombo, 1905.

Against this we find that the comparatively stunted oysters of the North-West Cheval Pár were ready for fishing at $3\frac{3}{4}$ years of age—a sample lifted in February 1874 giving the high valuation of Rs. 36-8-0 per 1,000.

Finely grown oysters on the South-East Cheval were also fished in 1878 at the reputed age of $4\frac{3}{4}$ years; their valuation three months prior thereto was Rs. 39-14-2 per 1,000.

The oysters fished on the Muttuvaratu Pár in March 1889 were reputed to be $4\frac{1}{2}$ years old, and in the November preceding, at the approximate age of $4\frac{1}{6}$ years, the valuation sample worked out at Rs. 10-2-4 per 1,000.

2. Uti Par Group.

A chain of six banks, the Nagara, Uti, Uduruvi, Kilati, Attuvaiarpagam and Patarai Párs constitute this group. All are of small and of about equal size, averaging from $\frac{1}{2}$ to $\frac{3}{4}$ of a mile in diameter. They lie in a depth of 7 to $8\frac{1}{2}$ fathoms, landwards of the Tolayiram Pár, at a distance of 5 to 7 miles from the shore. They stretch north and south about 3 miles.

The area is essentially rocky, the proportion of sandy ground intermingled with the rock insignificant.

Faunistically this area is richer and more diversified than the Tolayiram region, the intimate intermingling of rock and sand upon the latter producing effects when the sea is disturbed which but a comparatively few species of animals can tolerate.

The fauna agrees closely with that of those southern Ceylon banks lying off Negombo, notably with Uluwitte Pár which lies at the same depth.

The features characterising the Uti banks in common with those off Negombo are as follows:—

An abundance of sponges including a larger number of small species than in the case of the Tolayiram. *Siphonochalina communis* with its numerous commensals is among the most common; fixed corals are scarce; Zoophytes are profuse with many colonial masses of *Filograna* tubes and everywhere the curious branched tubes of *Eunice tubifex*. *Pinna* sp. covered with large Balani are conspicuous on the sandy ground.

The rocky bottom on the Uti banks is calcrete, containing in some places a considerable quantity of quartz grains embedded in a calcerous matrix—a quartzose limestone.

The only fisheries recorded from these banks during the last 120 years took place in 1792, 1830 and 1860-1861. In the last instance the oysters, said to be $4\frac{1}{2}$ years old, were abundant and of good fishing value. Adjacent banks are usually fished in the same season with these and separate figures of the number of oysters fished from the Uti banks are not available.

3. Pasi Group.

Two banks, the Pasi Pár and the Attonpatu Pár, may be linked together under this head. They lie 6 to 7 miles off Hare Island, Tuticorin, at a depth of 8 to 9 fathoms, and are situated nearly midway between the Uti Pár group and the western margin of the Tolayiram Pár.

These also were fished in 1861 together with the adjoining Uti Par and associated banks. Since then the only records of oysters present in quantity are—

1863	"Very young oysters and Suran."
1876	"Plenty of young oysters of $1\frac{1}{2}$ years."
1881	"Large numbers of oysters of one year of age with Suran in some places and covered with weeds."

In addition, in 1894, 1896 and 1901 some few young were found, but as their number was limited we may disregard them and draw the inference that like so many other banks on this side these two suffer rather from a shortage of spat than from inability to support in health those that do appear and survive the dangers of the first 18 months of existence.

The bottom on the rocky patches is the usual calcrete, the remainder of the ground fine sand with occasional chanks.

The young oysters found in 1901 lay principally on the sandy stretches.

4. Cruxian Group.

Another group of small pars, three in number, lying west of the island of Vantivu and about six miles from the mainland. The three constituent pars, Cruxian, Tundu and Vantivur Arupagam are to the north-north-west of the Uti group in rather shallower water, 6 to $6\frac{1}{2}$ fathoms.

The bottom on the pars consists of level stretches of continuous rock, brownish tinted calcrete exactly similar to that on the Uti pars.

The fauna differs considerably from that of the last-named banks. Sponges are less extensive, *Siphonochalina communis* being the most conspicuous and numerous.

Among other animals noted were large *Pinna* sp. in abundance rooted in the thin layer of sand covering the rock in many places, with *Balanus* and zoophytes crowding the exposed surfaces of the *Pinna; Eunice tubifex* in quantity; Heteroneid form of *Nereis* sp. in the canal system of *Suberites inconstans; Botrylloides* sp.; *Turbinella rapa* in the sand on the western side.

The large fishery of 1861 was contributed to from these banks, which appear more favourably situated than many others for receiving spat falls, some eight being recorded since 1861. Unfortunately in only three instances, 1878, 1884, and 1902, did the re-stocking take place on an extensive scale;—even in 1902 the quantity of $1\frac{1}{2}$ to 2 years old then present was estimated at but 1,700,000, a number too small to give good results two to three years after in view of the unpreventable wastage that must be allowed for.

In many respects the Cruxian group has points of resemblance with the North and South Moderagam Pars on the Ceylon side, notably in the in-shore situation, the comparative shallowness of the water and in the characteristic abundance and association together of *Pinna* and *Balanus*.

The ground referred to on the Ceylon side is much the more clean of the two, both faunistically and physically; the sand there is of the usual coarse grit and this, by the attrition of its movement during disturbed weather conditions effectually scours the bank, keeping down the growth of weed and other organisms unprotected by a hard external protective casing.

This mechanical cleansing of the bottom is nowhere well seen on the in-shore Indian banks where the fineness and low specific gravity of the sand lacks not only an adequate scouring force, but by reason of the presence in it of a certain amount of mud exercises a retarding influence upon oysters when they are present—an influence resulting in a stunting of the growth.

The fact has long been noted * that the size of Ceylon oysters of a given age from the Cheval par is markedly superior to that of those of the same age from the in-shore Indian banks, the latter approximating more closely to those from the Muttuvaratu Par, a bank with a bad reputation for the starved appearance characteristic of its oysters.

5. Vaipar karai Group.

The largest of these is the Vaipar Karai Par, a bank of some importance not located upon the present inspection chart. From the observations made and the information supplied by the par mandadai, it appears to lie north-west of the Devi Par and about five miles due south of the village of Vaipar. The other banks in this grouping are the Devi, Pernandu, Padutta Marikan and Padutta Marikan Tundu Pars, varying in diameter from half to three quarters of a mile. Depth 6 to $6\frac{1}{2}$ fathoms.

The bottom is of the usual reddish-brown limestone common to the other groups in this neighbourhood, interrupted and more or less overlaid by a fine muddy sand, the larger particles consisting chiefly of comminuted shells. Numerous dead

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* Thomas, H. Sullivan, *loc. cit.*, page 14.

pearl oyster valves, entire and also fragmentary, were abundant, fully $1\frac{1}{2}$ years old; of live ones but a few odd individuals were found greatly overgrown with tunicates and polyzoa and distinctly stunted in appearance.

The sand on the Vaipar Karai Par is appreciably more dirty and muddy than that on the Cruxian pars, a difference due to the vicinity of the embouchure of the Vaipar river. The other pars of the group are probably less affected but all have borne mature oysters, the group being included in the fishery ground of 1861.

The faunistic characters approximate to that of the Cruxian pars. *Pinna* sp. bearing large *Balani* predominate. A few corals (astræids) were seen with lepto-clinids and zoophytes.

Sponges are neither numerous nor conspicuous.

It appears from the records that these banks have suffered neglect in recent years, which in view of the fishery held there in 1861 and of the record by Captain Phipps of an abundance of young oysters in 1867, 1873, 1877, 1881 and 1884 they do not justify.

Thus the Karai Par received no attention for the years 1887 to 1894 and again from 1897 to 1903, both inclusive, a period of eight years in the one case and of seven in the other.

In the case of the other pars of the group the years of neglect are 1888 to 1890, 1892, 1893, 1898, 1900 and 1901, eight years in all.

It is quite conceivable that fishable oysters were missed through such omission and it emphasizes the contention I make elsewhere for a reorganization of the work of inspection upon such a scientific basis of accuracy and method as will preclude such lengthy periods of neglect.

A significant incident pointing to the imperfection of the methods in use in the management of these banks is the statement made in Mr. H. Sullivan Thomas' report* that oysters of $2\frac{1}{2}$ to 3 years of age were found in December 1869 upon the Pernandu, Padutta Marikan and Padutta Marikan Tundu Pars, while the entry for March 1869 states that these banks were totally devoid of oysters,—"blank". Comment is superfluous on such a state of affairs, not unknown either in the past history of the Ceylon banks.†

The Padutta Marikan Tundu par was one of the banks fished in 1830, the only record of a fishery on this par during the past century.

6. Nenjurichchan Par Group.

Three of the usual small pars, $\frac{3}{4}$ to one mile long, compose this group, namely, Nenjurichchan, Kundanjan, and Mela Onpatu Pars and cannot be treated otherwise than as a single unit. They lie at a distance of about 6 miles from the shore midway between Tuticorin and Pinnacoil. The depth is $7\frac{3}{4}$ to $8\frac{1}{4}$ fathoms.

The rocky surface is extensive and comparatively free from inorganic sand, what there is being composed largely of Foraminifera (*Orbitolites* and *Heterostegina*). The rock surface is level and well adapted for dredging purposes.

Physically and faunistically this group resembles closely the seaward side of the Ceylon Muttuvaratu Par. Like the latter it is rich in sponges and in Gorgonoids (*Gorgonia miniacea*, *Suberogorgia suberosa*, *Juncella juncea*), while the long-armed Asterid *Linckia leavigata* is fairly common.

The group has a disappointing history well expressed in the name of the median par—Nenjurichchan, literally "Heart-harrower". Why this should be so is difficult to say as the group lies but less than a mile to the south of the Tolayiram Par group; even the sandy stretch separating these groups carries occasional clusters of oysters and on the chank bed to the north-west it is not uncommon to find a dozen young oysters making use of the chanks in the absence of cultch and rock.

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* *Loc. cit.*, page 52.

† Twynam, Sir William—"Report on the Pearl Fishery of 1888," Ceylon, 1888, page 13, also Stewart—"Account of the Pearl Fisheries."

Probably the reason for such continued lack of oysters is due to some peculiarity in the set of the surface drift over these beds.

This group should receive regular attention during the next few years with a view to elucidate the reasons for this characteristic, note being taken (and recorded) of the character of the surface at each inspection, together, with particulars of the relative abundance of chief organisms met with, sponges, Gorgonoids, corals, the tubes of Eunice, "Suran", chanks, fishes and seaweeds.

7. Puli Pundu Group.

South-west of the Nenjurichchan group, this collection of small rocky banks comprising the Vada Onpatu, Saith Onpatu, Puli Pundu and Kanna Puli Pundu Pars, is situated about 9 miles north-east of Pinnacoil and some 8 miles west from the coast. The depth ranges between 7½ to 8½ fathoms.

The bottom of the pars is of flat-surfaced rock, somewhat patchy in distribution. Here and there is a small amount of cultch, more especially on the landward side, where a considerable amount of water-worn coral branches, "chullai", is present.

The par is mostly a fine grained and exceedingly dense limestone, reddish brown in tint and so hard as to ring under the hammer. Occasionally the traces of dead massive corals, *Astræa* or *Meandrina*, appear embedded *in the surface layer of this rock*, and are usually much bored into by tunnelling molluscs and sponges.

The parchment like tubes of *Eunice tubifex* are most profuse, their lower portions penetrating the tunnels already existing in the surface of the par-calcrete. The usual massive sponges, *Siphonochalina communis*, *Spongella nigra*, and *Suberites inconstans* are met with, while off the edge of the banks on the west and north chanks were met with in number together with occasional *Pinnæ*.

The history of the group is disappointing, no record existing of any fishery having taken place here, although there were spat falls noted in 1867, 1874, 1878, 1885, 1895, 1897 and 1901, all of small extent and of no practical importance.

The bank was not examined during the 8 *years between* 1886 *and* 1895.

Fishes are very plentiful on this ground and the area of rocky ground exposed is practically insignificant compared with the area of sand, while cultch is quite insufficient. It is possible that in these three disabilities we have the reasons for the smallness of the numbers of oysters noticed here from time to time.

8. Inner Kudamuttu Group.

A series, stretching north and south, of 6 small banks lying 5 to 6 miles off the coast between Pinnacoil and Kayalpattanam. The most northerly is the small Pinnacoil Seltan Par, the most southerly a small bank, unnamed upon the chart, lying a quarter of a mile south of the Saith Kudamuttu Par—the depth in all cases being 7½ to 8½ fathoms.

The general character of the rocky ground is almost identical with that characterising the Uti Par group which lies in the same depth of water. Many of the larger organisms found in the latter locality are also present here, sponges and Eunicid tubes coming up at nearly every dive. *Pinna* and *Balanus* were noted as absent from these banks—common features of the Uti pars. As on the latter, a few odd oysters remain from the generation noted in 1902 as being from 1½ to 2 years old; all were more or less enveloped in the orange-red sponge *Clathria indica*.

In 1818 Kudamuttu, Saith Kudamuttu and Putu Pars gave a fishery yielding Rs. 1,67,693. Ten years later they were fished again in conjunction with the neighbouring pars, and from an entry in Captain Phipp's list * that oysters 2½ to 3 years old were present in May 1860 and that no inspection was made in the two following years, I think there can be no doubt that mature fishable oysters were here also in 1861 or 1862, not being fished owing to a large number of other banks being stocked at the same date and receiving preference in the order of fishing.

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* Thomas, H. Sullivan, *loc. cit.*, p. 58.

The rocks show some diversity in character, dense and compact limestone passing in some places into a somewhat quartzose stone having a calcareous matrix. The hard bottom is much cut up by more or less extensive stretches of sand. Here and there we meet with loose fragments of calcrete similar in composition to the bed rock of the par; dead coral is fairly common in the form either of much honey-combed tabulae or of rolled and much worn broken madrepore branches, derived probably by the action of backwash and under-current from the extensive coral reefs that fringe the adjacent coast.

Chank beds lie to the south, east, and west of these banks, forming virtually a girdling of chank-producing sands.

A list of the common forms of life met with here is given on page 102 together with other details.

The term Kudamuttu used in the names of these banks is significant. It means literally the "Pearl Bay", so that the shallow indentation off which these banks lie and which has Hare Island, Tuticorin, and Trichendur point as its northern and southern limits, with the mouth of the Tambraparni river at the centre of its curve, appears to have been termed the Pearl-bay, *par excellence*, from the renown of the pearl fisheries held there. Kolkoi and Kayal were at the embochure of the Tambraparni, so we have in Kudamuttu further indirect evidence that the towns named were located near the centre of the most prolific pearl fisheries of early and mediæval times, the periods when they flourished respectively.

9. Outer Kudamuttu Group.

This is a congery of some six small banks lying due east of the Inner Kudamuttu group. It measures some two miles north and south by the same from east to west, with an average depth of 9 to 10 fathoms.

No fishery is recorded from these banks; neither do we know of any extensive spat fall in any year since the inspection record begins in 1863. Time did not permit of an extensive examination this year.

10. Kadian Group.

This collection lies about seven miles west of Pinnacoil and due south of the Kudamuttu group from which it is separated by a narrow chank bed. To the south it marches with the Karuwal group. In depth it agrees with the former—$7\frac{1}{2}$ to 8 fathoms.

The two principal patches of rocky ground are the Kadian and Kanawa Párs, each of about half a mile in diameter. The whole group covers an extent measuring approximately two miles from north to south by one and a half from east to west.

In its fauna, physical structure, and history, it is in close agreement with the inner Kudamuttu region, and was fished in conjunction with the Kudamuttu Párs in 1828. Spat falls have several times been recorded since 1861, namely in 1878, 1881, 1895 and 1897 when young oysters lay thick on all the rocky outcrops and wherever there was any cultch, quantities being found adhering even to the valves of *Pinna*, which are fairly abundant on the edge of the sandy ground on the western margin.

The generation of oysters seen for the first time in 1897 were reported healthy and still plentiful in the following year, but in 1899 the bank was described as almost bare of oysters. A very large number of byssal cables was noticed at this 1899 inspection, indicating probably a recent inroad by rays (*Rhinoptera* sp.) upon what must have been a promising bed of oysters.

The Inspector, I observe, remarks that the presence of these byssal strands "shows plainly that the oysters of last year have migrated", a deduction not warranted by an intimate knowledge of the habits of the pearl oyster.

Whenever an occurrence of this nature be met with, care should be taken to ascertain the condition of the individual byssal cables; we require to know whether the majority show signs of having been broken with violence as happens normally when oysters are torn away from their attachment, or if the strands of each cable

join together at the free end in a pale coloured semi-gelatinous "root". Only if such "roots" be present can we infer voluntary migration, for when an oyster decides to shift its quarters it sloughs the root of the byssus; it never severs it —indeed such is an impossibility. In any case a pearl oyster's migration is hardly worthy of such a designation; at the most its journey can be measured in yards and for practical purposes the power may be ignored—a power of little advantage to the possessor except to shift position from one side of a fragment of rock to another. Thus I have seen an oyster three years old crawl four inches up the side of a stone to get away from an eddy of sand playing round the base.

11. Karuwal Group.

A series of the usual small rocky patches called pars lying seven miles east-north-east from Tiruchendur Pagoda. The depth is $7\frac{1}{2}$ to 8 fathoms.

The principal banks are Velangu Karuwal and the Karai Karuwal occupying the southern portion of the group, with the Periya Malai Piditta and Naduvu Malai Piditta Párs on the north, the whole scattered over an area about three miles long by from one to two miles broad in an east to west direction.

The rocky areas have the same general features as the other párs of the Central division lying in a similar depth—flat-surfaced rock outcropping in patches of different size from a surrounding waste of sand.

The rock is the usual somewhat variable calcareous calcrete. The sand to the west of the group is fine grained and passes gradually into a chank bed. On the pár region proper the composition of the sand varies considerably; on the surface of the lock foraminifera (*Orbitolites* and allied forms) form a notable proportion of the bulk; elsewhere the grain becomes frequently coarse and occasionally grades into a distinct gravel. On the northern section a considerable amount of small Lithothamnion balls is locally abundant.

Among the characteristic organisms we have *Siphonchalina communis*, *Spongionella nigra*, *Axinella tubulata*, *Axinella donnani*, *Clathria indica*.

A few corals, chiefly *Favia sp.* (no Madrepores were seen); *eunice tubifex* is abundant.

Other common organisms are *Pentaceros lincki*, *Linckia lævigata*, *Antedon spp.* *Ophuiroids*; *Scrupocellaria sp*; *Padina commersoni*, *Codium tomentosum.*

A considerable number of dead oyster shells were found of a size of those from two and a half to three years old. Living oysters of about the same age were present here and there, the majority enveloped in the encrusting mass of *Clathria indica.*

The Karuwal group has brought oysters to maturity more frequently than any other bank save the Tolayiram Pár during the last century—in 1805, 1815 and 1862. Since the last named date young oysters have appeared here in quantity at least five times,—in 1863, 1874, 1878, 1884 and 1897; no inspection of the Karai Karuwal was made in 1865, 1870, 1873, 1874, 1875, 1877, 1887, 1889–1890, 1892–1893, 1900 and 1902.

The oysters found in 1897 were still on the párs in 1899 and would have been ready to fish the following year when however the bank was not examined, owing presumably to the fishery then in progress on the neighbouring Teradi Puli Piditta Pár.

The fishery of 1862 on these banks produced a net profit to Government of Rs. 1,10,619.

The general characteristics of the Karuwal group are the most favourable of any seen during the investigation, the ground approximating most nearly to the condition found on certain of the better parts of the Cheval Pár—the most valuable and reliable of all the Ceylon banks.

In both cases we find the depth of water about the same, while the bottom on the Karuwal group has a diversity in physical characters somewhat approaching that found on the Cheval, stretches of rock much broken up by patches of sand overlaid in places with a considerable quantity of cultch consisting of loose blocks of calcrete,

nodular masses of Lithothamnion ("kottcipakku") and worn fragments of dead coral ("chullai"). Such diversity seems a condition specially suited to the requirements of oysters.

12. Odakarai Par.

A bank lying six miles west of Trichendur and due south of the Karuwal group with which it appears to be linked in its main characteristics.

Much of the bottom is well cultched with Lithothamnion nodules * and the extent of rocky bottom is satisfactory, the pár extending about $1\frac{1}{2}$ mile north and south. The depth is 8 to $8\frac{1}{2}$ fathoms.

Prior to 1885, this, in common with the banks included under the term Manapad group, received insufficient attention and *there can be little doubt that fishable oysters occupied the bank in* 1900 *and perhaps in* 1901,—years when no examination was made, although it was reported in 1899 that oysters of $2\frac{1}{2}$ inches in depth were sufficiently numerous to give 20 to a dive.

In the 44 years since 1860 the bank was examined sixteen times only, *so that no inspection was made during* 28 *years. Twice there was no examination for five years in succession, and this in view of the bank being for all practical purposes a portion of the most prolific oyster-maturing ground on this coast!*

13. Chodi Par.

A bank four miles west of Trichendur in $8\frac{1}{4}$ to 9 fathoms of water. I had no opportunity to examine it.

According to the inspection records it bore oysters of one, two and three years of age in 1869 and is described as being covered with shells and coarse sand about six inches to a foot deep in 1891 and 1894. It is marked as "useless" in the summary of 1899, a conclusion I do not think is justifiable in view of (*a*) the oysters met with here in 1869 and (*b*) its proximity (one mile north) to the Tundu Pár which yielded oysters at the fishery of 1900. It is noteworthy in this connection to observe that these Tundu Pár oysters were not known to the Inspector prior to the fishery in question, being discovered accidentally by the divers on their way to the fishery ground on the Teradi Puli Piditta Pár. Once again I feel driven to the conclusion that inspection work has too frequently been performed in perfunctory manner, with want of method and over too limited an area. Only ten times since 1860 has any attention been paid to this bank and in view of the imperfect method of inspection employed I am far from being convinced that the examination was efficiently carried out and that the results shown are reliable. In most years no note is supplied of the number of dives made, and in the absence of this we have no guide to the thoroughness of the work done. I shall return to a consideration of this vitally important subject when dealing with general conclusions.

14. Tundu Par.

A bank lying one mile south of Chodi Pár at the same distance from land, depth from 9 to $9\frac{1}{2}$ fathoms.

It appears to have been fourteen times examined in the course of the last 44 years. In 1897 it was not examined; in 1898 oysters were "plentiful, 35 to a dive, two inches in size and healthy in appearance"; the succeeding year states "Nothing of value", while in 1900 the fishing fleet stumbled by chance on a fine bed of oysters, fully four years old on this very bank, a telling impeachment of the accuracy of the general results of the examination carried out in the preceding year! The oysters plentiful in 1898, and missed at the regular inspection of 1899, would assuredly have matured and died unknown had the accidental rediscovery of the bed not been made by the divers on their way to the "official" fishing ground.

The fishery of 1900 proves the good potentialities of this bank, which deserves regular and careful attention in common with all the groups in this neighbourhood. It is also to be noted to the credit of this bank that the oysters fished here in 1900 were larger shells than those from the Teradi Puli Piditta Par and fetched better prices than the latter.

* Inspection Report, 1887.

It was remarked that the Tundu Par oysters were covered with weed, whereas those from the other par were practically clean.*

15. Manapad Group.

Under this name I propose to include a one ranked series of pars extending over 6 miles north-east and south-west parallel with the coast between Trichendur Pagoda and Manapad point. They lie at an average distance of 8 miles from land. The depth ranges within close limits from 8 to 9 fathoms.

From north to south the names of the constituent banks read—Trichendur Puntottam Par, Sandamacoil Piditta Par, Teradi Puli Piditta Par, Semman Patt Par, and Manapad Par, together with a few smaller rocky patches.

Prior to 1885 these banks received scant attention and were seldom examined, under the impression I believe, that they were of little or no value. However in 1897, oysters ranging from $\frac{3}{8}$ inch to $1\frac{1}{2}$ inch in depth were found on Sandamacoil Piditta, Teradi Puli Piditta, Semman Patt Par, Surukku Onpatu Par (Manapad Par appears omitted from every inspection since 1860 !) and in 1899 well-grown healthy oysters were found plentiful on all the four banks.

The following year the Teradi Puli Piditta Par was fished together with the Tundu Par already described. Unfortunately the quality of the oysters from the former par was too poor to encourage the divers to attend in large numbers and continue for a prolonged period. It appears possible that they were fished a year too early, though this is a point that was not definitely settled.

The valuation of a sample of these oysters in the October preceding was reported to be Rs. 10–2–0 per 1,000 and according to the experience of many fisheries on the Ceylon side, the actual price obtained at the fishery following is invariably considerably higher. In the present case Government had the utmost difficulty in obtaining the valuation figure and indeed were we to exclude the larger and finer Tundu par oysters, the price at which the Teradi Puli Piditta oysters were sold would be found to be below the sample valuation.

It would be found of great assistance to Government and to buyers alike if a second valuation sample of oysters were drawn immediately prior to the fishery, say ten days preceding, in addition to the one obtained in the October or November of the preceding year. This is regularly done at the Ceylon fisheries and serves as an efficient check and corroboration both of the accuracy of the preliminary valuation and of the identity of the ground selected for fishing with that from which the first sample was taken. As showing the possibility of error in localization of patches of oysters when the organization is imperfect, are the two well-known instances of this given by Sir William Twynam, namely—

(*a*) How in 1836 two beds of young oysters were fished in error instead of one bearing old and properly matured ones, and (*b*) how the fishery of 1860 on the Moderagam was all but lost, a long continued search of three days being necessitated ere the bed was rediscovered.†

An omission which I cannot understand is the fact that no inspection was made of the Semman Patt and Surukku Onpatu Pars in 1901 as they bore oysters in 1899 of the same age and in the same abundance as those on the Teradi Puli Piditta Par. No examination of these was made in 1900 and it is quite probable that patches of fine quality and large sized oysters might have furnished a fishery on these pars in the year named. This region in 1901 was by far the most important to examine and for some reason or lack of system the obvious was not carried out.

Southern or Comorin Division.

Of the banks forming this division and stretching from Manapad southwards to Cape Comorin little is known. A list of some of these banks is given on page 103. Of these only the Manapad Periya Par appears to have received any attention. This bank lying in $5\frac{3}{4}$ to 7 fathoms is nearly 10 miles in length by about one mile

* "Proceedings, Board of Revenue, Madras," No. 208, October 1900.
† "Report on the Ceylon Pearl Fisheries", 1902, page 20.

in breadth. It lies from 6 to 10 miles off the coast, south-east of Manapad and about 5 miles south-west of the southern extremity of the Manapad group of pars. No information is given in the inspection summary of the character of the bottom. It would be advisable if the Inspector be instructed to pay special attention to this group during the next few inspections in order to obtain data for comparison of these banks with the better-known ones of the Central division.

Historical evidence as already quoted points to some at least of these banks being occasionally productive. I know of no physical reason why such conditions should cease.

Northern or Kilakarai Division.

The limits of the banks comprised in this category lie between Vaipar on the south and the Island of Rámésvaram on the north, a distance of 60 miles. In the past considerable attention has been devoted to their examination, very much more indeed than that given to those of the Southern division which are more deserving of such care.

All these northern pars suffer from the excessive turbidity of the sea which prevails during stormy weather. The proportion of mud present in their sand is much greater than in the case of either the Central or the Southern division, and as a consequence pearl oysters exist in a condition of chronic starvation, are stunted from an early period and never survive to a fishable age, if we may judge by the records of the past 100 years and from the effects I have noticed in those experiments where I have kept oysters under circumstances simulating a like condition of silt-laden water.

Much of this mud is derived from the rivers entering the sea between Vaipar and Pámban, mud which moves north-east up the coast during the south-west monsoon period. In several places eddies caused by the deflection of the current by the presence of the chain of islands lying parallel with this part of the coast conduce to the formation of mud deposits at definite localities, one of which we found between Nallatanni Tivu and Upputanni Tivu Pars; other mud deposits are marked on the Admiralty chart.

Between Nallatanni Tivu and Pámban the banks have all the useless characteristics of the Ceylon banks immediately south of Mannaar island and are distinguished by an inordinate luxuriance in growth and variety of Algae, such as *Laurencia*, *Polysiphonia*, *Corallina*, *Chrysymenia uvaria*, *Halimida tuna*, and *Kallymenia perforata*.

Such pars are, I fear, uniformly valueless and unworthy of inspection oftener than once in four years.

Greater attention is required in the southern portion of the division where there exists the possibility, rendered somewhat definite by the presence of the remains of a fishery camp on Nallatanni Tivu, of oysters some day maturing. The prospect is not hopeful but is sufficient to justify an inspection in alternate years. The pars requiring the most attention are the Upputanni Tivu, the Nallatanni Tivu and the Vembar Periya Pars. The two first lie four miles off the coast south and south-east of Valinukam Point, the last south-east of Vembar village.

The rocky bottom on all these pars is the usual brownish dense limestone calcrete, while the sand is in most cases rather finer than that from the Central and Southern divisions and the amount of mud mingled with it is very markedly greater in quantity.

When inspection of this ground be made, diving and dredging traverses should be made over the whole of the ground at depths between $7\frac{1}{2}$ and 10 fathoms to the south and east of the two Tanni Tivu and Vembar Pars. Some of the ground we met here was distinctly promising, and being further from land and at greater depth the bottom is more free from mud than on the inshore banks.

The characteristic organisms of the Tanni Tivu Pars are sponges in great abundance (see page 28 for names), various Gorgonoids, notably *Juncella juncea*, an occasional Astraeid, the tubes of *Eunice tubifex* and numbers of *Pinna*; *Modiola barbata* (suran) generally absent.

Kumulam Par is valueless, as are also Valinukam and Valinukam Tundu Pars and some others in shallow water between Valinukam and Vembar.

VI.

CONCLUSIONS AND RECOMMENDATIONS.

A. CONCLUSIONS.

The outstanding conclusions of supreme importance to which my investigation of the records and natural characteristics of the Tinnevelly and Madura pearl banks has led are that the banks have latterly given inferior returns owing to—

(*a*) The imperfections of past and present methods of inspection, and
(*b*) Deficiency in the supply of divers when fisheries are held.

Imperfect Methods of Inspection.

The Ceylon banks have certainly enjoyed larger measures of supervision and a more developed inspectional organization during the past half century than the Madras banks and probably during the preceding 50 years as well. They were, however, inspected in a very imperfect manner till the early sixties, when Captain Donnan introduced improved methods. Prior to that time, owing to the charts in use being imperfect and the landmarks insufficient in number and in conspicuousness, the Inspectors relied in great part upon information supplied by native headmen. The boats employed were often ill-adapted to the purpose and the search for beds was not conducted with anything approaching scientific precision.

As already mentioned, Captain Donnan, who was Inspector from 1863 to 1902, organized matters on an improved basis and so far as nautical knowledge permits brought the mechanical part of the inspection to a high level of excellence. By the preparation of large scale charts, whereon he plotted every landmark of value and the outlines of many of the pars, he was enabled to dispense with the services of the headmen ; he abolished the unhandy " ballams " which served as the inspection divers' boats, introducing in their place a handy type of whale boat ; he elaborated an admirable system of " circle inspection " capable of supplying detailed information in regard to the minute features of the ground inspected—the respective numbers of old and young oysters present, the ratio of sandy ground to rocky and the distribution of oysters over it. He trained intelligent natives (Parawas) to act as coxswains of these boats and to record in diagram form the results of each and every dive made during the day's work.

The present state of the Tuticorin inspection organization is similar to that characterising Ceylon inspection prior to the inception of Captain Donnan's improvements. Charts are imperfect and do not show the position of the chief landmarks ; * native pilots (par-mandadais) have to be employed ; circle inspection is not carried on in an adequate and systematic manner ; native boats are still employed for the divers' use and no attempt has been made to train efficient coxswains to keep records of the work done with exactitude. As a consequence of such imperfect methods I am convinced that beds of oysters have been missed and fisheries lost from time to time. Such mischances certainly did happen on the Ceylon side under similar conditions. In the experiences given by Captain Steuart in his " Account of the Pearl Fisheries " his belief is several times stated that beds of oysters had repeatedly been missed and that even in 1836 a bank was lost and two or three beds of young oysters fished by mistake. He " attributed this in great measure to the clumsy boats used for inspections and the ignorance of the native headmen ". Sir William Twynam (" Report on the Pearl Fishery of 1888," page 13) in commenting on this has no doubt that want of proper landmarks, incorrect (or rather confused) compass bearings, incorrect charts and unsatisfactory inspections had a great deal to do with such lost fisheries—*a conclusion which I cannot improve upon when commenting upon the past and present methods in use in the examination of the Tuticorin banks.*

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* See charts A and B in annexures.

Until the present day, a sea-faring education has been considered the fitting mental equipment for Officers in charge of the Pearl Banks of Ceylon and India. Men who had passed their youth and early manhood on the sea were appointed, the impression being that nautical knowledge and elementary marine surveying were the chief qualifications for these duties. Captain Donnan has been without doubt the ablest of these nautical Inspectors, but far as he carried the improvement of inspection methods, lack of biological knowledge prevented him from so economizing his time as to enable him to examine each season the whole of the potential oyster-bearing ground in his charge. In this way it was that often enough precious days and weeks were devoted to the examinaation of ground which a biologist would have decided at once to be unworthy of detailed circle inspection, while other large areas, biologically more favourable to oyster growth, had to be left wholly or partially unsurveyed for want of available time.

A concrete instance of the imperfection of present inspection methods on the Tuticorin banks is afforded by the last fishery held, that of 1900. The bed to be fished was the Teradi Puli Piditta Par off Trichendúr; fishing went on there for three days, but, on the fourth, some of the boats, owing to a strong head wind, were not able to fetch the proper bank and anchored three miles away on the Tundu Par, where to the surprise of everyone—officials included—they found quantities of oysters larger and apparently older than those on the advertised bank *. The inspection records for the preceding four years, if the examination had been efficiently carried out should have indicated the presence of oysters each year at this locality. The actual record is, however, as follows † :—

1895 } 1896 }	...	"Bare of oysters".
"1897	...	Not examined".
"1898	...	Oysters plentiful, 35 to a dive, 2 inches in size, healthy in appearance."
"1899	...	Nothing of value." (*sic* !)

The inefficiency of present inspection methods is palpable. The oysters fished in 1900 were estimated by Captain James as four years old (*loc. cit.*), so that by the Inspector's own showing this particular bed was missed on two occasions out of the three that it was examined. Oysters do not and cannot migrate, and if the oysters seen in 1898 and fished in 1900, were missed in 1896 and 1899, we cannot do otherwise than condemn the character of the methods employed in inspection.

Who can say how many similar oversights there have been? Careful scrutiny of the inspection records show many suspicious entries. Take the Karai Karuwal Par, one of the most productive banks in this region. The records for 1897–1902 run thus:—

"1897	...	Large quantities of young oysters, healthy in appearance, $1\frac{3}{4}$ to $\frac{5}{8}$ inch in size.
"1898	...	Oysters plentiful, 35 to a dive, 2 inches in size, healthy in appearance.
"1899	...	Hundred and seventeen oysters, $2\frac{3}{4}$ inches in size; among these eleven dead shells.
"1900	...	Not examined.
"1901	...	Coral, weeds, pinna. No oysters.
"1902	...	Not examined."

Can we doubt that a fishery was missed in 1900?

The records of the Velangu Karuwal Par and the Trichendúr Puntottam Par are identical.

On the Odakarai Par in 1899 there were "oysters, 20 to a dive, $2\frac{1}{2}$ inches in size, healthy. A very small quantity of dead shells were found. Divers report that the undertow was very heavy and that they had much difficulty in keeping on their feet. Large quantity of weed on this bank," but no examination was made in 1900, 1901 or 1902!

Mr. Sullivan Thomas remarked the same discrepancies in the inspection records.‡ He says:—

* "Madras Board of Revenue Proceedings," No. 208, dated October 1900, page 4.
† Copied from the Inspection Registers in the office of the Superintendent of Pearl Fisheries, Tuticorin.
‡ "Report on Pearl Fisheries and Chank Fisheries", Madras, 1884, page 24, paragraphs 76 and 77.

"Looking for instances of oysters that have been obviously missed, we find that "in 1869, banks 15 and 16 contained oysters of 2½ and 3 years old in December, "where a blank was recorded in March of the same year. Again, in March of the "same year, bank 49 held 'many oysters of 1, 2 and 3 years of age,' which for want of "inspection had not been found before. In April 1878, banks 44 and 45 'were "thickly covered with oysters of one year age', and in May of the following year the "record is 'blank'. If they had not migrated and been missed, we might perhaps "have found some traces of at least a few dead shells. In 1882, we find 'dead "shells' of we know not what age on bank 20, which the previous year was "'blank'.

"Banks 15, 16, 17 might seemingly have been fished in 1870, but they were not "inspected. Perhaps Captain Phipps was away; perhaps the necessity for inspection "was lost sight of for want of statement B."

I may add that long weeks before I made my investigation and before I had acquaintance with the facts above related, my most intelligent coxswain, a Tuticorin man himself, in reply to my inquiry if he had any theory why oysters came to maturity so seldom on the Indian banks, said "oysters often come, inspection not good, not wide enough". He remarked that he and his people often said among themselves that if the Indian inspection was carried out in the thorough manner it is on the Ceylon side there would be more frequent fisheries. As he said, long ago fisheries were very good off Tuticorin and Káyalpatnam,—why should they now be so very few and unprofitable? This opinion expressed, I believe, his honest belief; there was no advantage in deceiving me and at that time he had no idea that I was likely to have any connection with the Indian banks. Candid opinion of the native fishermen is often shrewd and well considered, and I agree cordially with Mr. Sullivan Thomas in his remark "as regards fisherfolk knowledge—it is marvellously good and should never be neglected, but at the same time always tested." * In other words the ideas of the local fishermen and divers may often furnish a valuable working hypothesis.

Numerical Deficiency of Divers attending the Fisheries.

Apart from any question of the fertility of the banks, the inadequate supply of divers attending the Tuticorin fisheries has frequently entailed disastrous financial consequences, notably in 1889 and 1890. In those years large fisheries took place concurrently off the Ceylon coast, and as the Ceylon fisheries are believed by the divers to yield them better results than those on the Indian coast, it was with considerable difficulty that any men were prevailed upon to attend the latter. This state of affairs was well known among the native merchants and all the more wealthy resorted accordingly to Ceylon as the market possessed of the greater attractions. Their abstention further influenced the results adversely.

Take the fishery of 1889 for example. In that year the Tolayiram Par was densely stocked with fine oysters nearly six years old. Captain Phipps, the then Superintendent of Pearl Fisheries, calculated that there were 309,760,000 oysters upon the bank; but for want of sufficient boats and divers the gross take, 12,600,000 oysters, barely reached 4 per cent. of the estimated total available. The average number of boats out per day was 35; the largest on any one occasion was but 48.

The next year, when the oysters were dying off, an even worse state of affairs prevailed; the average number of boats employed per day fell to 21 and the total take of oysters was a miserable million and three quarters (1,806,762), bringing in a paltry profit of Rs. 7,803 to the Government.

The ensuing year, as was to be expected from the age limit being exceeded, no oysters were found on the banks.

The combined takes of 1889 and 1890 were under 14,500,000 oysters, so that if we accept Captain Phipps' estimate of over 309,000,000 on the bank in 1889, the Government harvested a wholly inadequate proportion of the crop. Can we justly characterize the Indian banks as being poor and unsatisfactory when one bank brings such a multitude to maturity in one year? Is it not more reasonable to lay the

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* *Loc. cit.*, page 25.

blame on antiquated methods and lack of foresight and method in organization? The average price obtained per thousand in 1889 was Rs. 22-8-6; therefore if the organization of the fishery had ensured, as it ought to have done, the lifting, we will not say of the whole 309,000,000 of Captain Phipps' estimate, but merely of a modest 50,000,000 oysters, then, instead of taking but Rs. 1,89,986 in 1889, Government would have had a revenue of Rs. 7,50,000—a preventible loss occurred of over 5 lakhs of rupees.

The actual take was, however, as I have stated, but 4 per cent. of the estimated crop; 96 per cent. was literally thrown away for want of the means to gather it in.

To overcome the labour difficulty created by the preference shown by the divers for Ceylon when fisheries coincide in the same year on each side of the Gulf of Mannar, it was recommended by the Board of Revenue in August 1890 that efforts should be made to arrive at some arrangement with the Ceylon Government, the basis of arrangement to be either a division of the fishing season in point of time or a limitation of the number of boats employed upon the Ceylon side.

Subsequently an agreement was actually arrived at * upon the former basis whereby when fisheries on the two sides of the Gulf should occur in the same season in any future year, it was agreed that the Ceylon fishery should begin in February and close at the end of March, leaving April and May for the prosecution of the Tuticorin fishery.

From the experience I have had of actual fishing conditions, I am of opinion that in practice this agreement will be found unworkable. The beginning of February is too early in the season to start fishing on the Ceylon coast. Divers will not attend till weather conditions become settled, till the intermonsoon lull begins, characterized by alternating land and sea breezes and by clear limpid water free from suspended particles of mud and sand.

No dependence can be placed upon the oncome of this period prior to the first week in March, and I cannot see how the Ceylon Government can agree to close their fishery some three weeks after the date of actual opening and just when the fishing is probably at its best. Apart from governmental considerations such a proceeding would be deeply resented by the divers and the merchants; if they were compelled to go, the fishery being summarily closed, the consequences would be felt at subsequent fisheries. The proposal is only practicable if fishing could be begun early in February and this as I have said is impossible owing to circumstances beyond the control of the Ceylon Government. Neither can the Ceylon Government limit the number of boats participating if there be sufficient abundance of pearl oysters to justify the work, indeed it would be an advantage to Madras if the Ceylon Government were able to obtain such a number of boats as would clear the bank to be fished in a limited period, as then the divers would be at liberty to depart and would be available for the Indian beds. However, even in the case of a cessation of the Ceylon fishery at the end of March, I am convinced that an Indian fishery in April and May would benefit thereby very little if the Ceylon fishery had been at all successful. At a fishery, such as the Ceylon one of this year, the divers make so much money as to be wealthy beyond their dreams of avarice for that year at least. The more prudent Moormen have made enough money to enable them to invest in new fishing nets, new boats, or jewellery and dowries for their women, while the thriftless Parawas find enough money in their pockets to hand a substantial sum to their Church and leave enough over to permit them to feast and be merry for several weeks or, perhaps, even months.

Such men will be induced only with the utmost difficulty to undertake a second diving season hard on the heels of the first; they will be restless, discontented, and eager to seize any excuse to get away. Witness what happened in 1890 when a number of divers returning from fishing on the Ceylon banks, were pursuaded to resume operations off Tuticorin; only eight days fishing was obtained as the divers utilized with their usual skill the stalking-horse cry of "sharks on the banks". As any stick is good enough to beat a dog, so any excuse is considered good enough to utilize when the divers for any reason wish a fishery to come to an end. At one time it is "sharks"; at another, the alleged scarcity of oysters, "chippi illei". Illness,

* In February 1892, according to information supplied from the Colonial Secretary's office, Colombo.

rumours of cholera, small profits, rough weather, chill winds, are all utilized with the utmost cunning but the true reason—that they have made enough money—is always kept in the background.

Hence I conclude that relief must be sought in some other manner and that it is necessary for the Madras Government to proceed entirely independently of the Ceylon authorities and to accept, as an unpalatable but none the less living reality, the fact that till present conditions be radically reformed, the Tuticorin and Kilakarai divers have not the requisite confidence in the Tinnevelly pearl fishery administration to induce them to forego attendance at a Ceylon fishery when such clashes with one on the Indian banks.

Many years ago Captain Worsley, when acting as Supervisor of the Ceylon Pearl Banks, summed up his conception of the Inspector's duties towards the oysters under his charge in the dictum "find them, watch them, fish them". I have shown that the organization of the Indian Pearl Fishery Department has failed notable in all these operations, lamentably so in 1889.

Detailed inspection carried out with scientific accuracy by a capable officer endowed with biological knowledge and with acquaintance with elementary marine surveying, furnishes a sufficient remedy for the first and second of these administrative diseases; the third is more difficult to cure, though much improvement might be counted on as certain to take place when the divers become aware of the improvements taking place in the methods of inspection. With confidence in their Inspector and in the statements he might publish regarding the promising character of a bank about to be fished, many would, I believe, voluntarily remain at home in spite of Ceylonese counter attraction.

This we must not, however, count upon till the new organization proves its efficiency by results, and we come back again to the problem, how can we fish a large number of oysters, say 50,000,000, during a fishing period not exceeding eight weeks (March and April), in spite of the defection of the great bulk of the local divers?

I can think of but two alternatives, (*a*) the utilization of mechanical means and (*b*) the drafting to the fishery of a sufficient body of Arab divers.

Regarding the former plan, although the character of the bottom on the Tolayiram Par is favourable to the employment of the dredge, the numbers of oysters to be dealt with are so enormous and the occurrence of fisheries so erratic and occasionally so long deferred, that at present I cannot see that this is a practicable solution, so long as the fishery be conducted by Government. A fleet of dredging vessels would be required and the maintenance of these cannot be justified till a cultural scheme be perfected which will ensure tolerably regular periodic (annual) fisheries. The most that is feasible is to fit the fishery steamer with dredging equipment and so enable her to do her share in the actual fishing operations.* The same equipment would serve for the dredging of young oysters for the purposes of transplantation, and it might also be utilized for the dredging of chanks, though I doubt whether the results from the last-named work would be sufficiently remunerative and would counterbalance the extra expenditure that would be occasioned in coal and oil.

The alternative of obtaining a supply of Arab divers adequate to work the fishery is left us. It appears to me that if due precautions be taken to obtain true Persian Gulf divers in small gangs under men who can give adequate monetary guarantee for the good behaviour of the men supplied by them, that this plan is eminently feasible.

At the present year's Ceylon Fishery (1904) 258 Arabs were allowed employment and Mr. Lewis, Superintendent of the Fishery, states in his report:†

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* The results obtained during the Ceylon fishery of 1905, show that an average of 35,000 oysters may be reckoned as the daily catch of a properly equipped small dredging steamer under good management. The cost of wages and upkeep is considerably less than the value of the divers' share of oysters, so we find dredging to be a more economical mode of fishing than the employment of divers on the one-third share basis, provided work can be found for the steamer in the off season.

† "Reports on the Pearl Fishery of 1904." Sessional paper No. XIII, Ceylon, 1904, page 6.

"As the fishery proceeded and the advantage of having them had become "apparent, I was prepared to take more. They gave very little trouble, and were "very useful both for the starting of the fishing and for keeping it going towards the "end. They were always most keen on going out, no matter what the weather was, and "they rather roughly handled a Jaffna tindal who started for the fishing one morning "but turned back because his sail split. They offered to mend it for him, but he said "he had no materials. Their indignation was great, and they were loud in their "complaints. They are as used to handling boats as they are to diving, and had "great contempt for tindals who were deterred from proceeding to the banks owing "to small accidents to their boat or gear."

Further evidence of the good work and reasonable disposition of these Arab divers when treated justly, is afforded in Captain James' report on the 1900 Tinnevelly fishery, * his words being—"At first there must have been quite 1,500 divers, of "which about 200 were Arabs. These latter I consider quite the best men to have "at a fishery, quiet, good-tempered and hardworking, and quite amenable to all "discipline, much more so than the Paravas who are a constant source of trouble, both "on the banks and in the Kottoo, where they were constantly being caught concealing "oysters, which of course were always confiscated. Only one Arab was caught "doing this, and his companions abused him for disgracing them. The Malayali "divers left the banks after the first few days as the water was too deep."

Fortified with such favourable opinions from men who had to meet and control these divers ashore, where trouble is more likely to occur than at sea, I have no hesitation in saying that I have the highest possible opinion of these men and of the quiet, methodical, and energetic manner in which they conduct their work. I watched them at work daily throughout the last two fisheries, and they were ship-companions with me when toward the end of the 1904 fishery they agreed to fish from the Government steamers.

Such daily contact afforded me opportunity to obtain insight into their characters and as a result I found them more willing to obey my orders and follow suggestions than either the Parawas or the Kilakarai Moormen—a result due naturally to their higher intelligence. Quick tempered they are and restive under even the suspicion of injustice, but withal reasonable and eminently amenable to fair treatment. Personally I should not hesitate to run a fishery entirely with Arabs, and if ordinary precautions were taken to exclude the scum of Bombay, I am satisfied that perfect order would prevail.

During the north-east monsoon, numbers of these men visit the ports of Canara and Malabar, whence they might readily be obtained.†

Banks of Greatest Value.

Descending to matters of detail, the present investigation shows that certain of the Párs or rather certain groups of Párs are more worthy of particular attention than others. The same conclusion has been drawn with regard to the Ceylon Párs; some are clearly to be classed as favourable to the maturing of oysters, while others—the majority—are wholly unreliable in this respect.

Of the banks off the Indian coast, historical, physical, and biological evidence combine to show that the Tolayiram Pár and the Kudamuttu and Karuwal groups of Párs are the highest in relative importance, bearing the more frequent spat falls and yielding the major number of the fisheries that we are able to localize.

The Northern or Kilakarai division is of little economic importance; prolonged inspection is not requisite in this region and the time formerly devoted to this purpose can be employed to better advantage in making more detailed examination of the Párs of the Central division and in carefully prospecting in the region lying between the Karuwal group and Cape Comorin.

* "Proceedings, Board of Revenue," Madras, No. 208, 1900.

† Since the above was written, I have had experience of another large pearl fishery, at which a largely increased contingent of Arabs, some 2,000 in number, was employed. Their conduct was again eminently satisfactory. They gave no trouble whatsoever.

The region last named has been neglected almost entirely in the past; during the last 45 years only a small portion of the area has received any attention on thirteen occasions, while many square miles of sea bottom have been systematically ignored in this region, which we have conclusive evidence to show formerly yielded fisheries.

The Tolayiram Pár deserves the Inspector's greatest attention; it is the sole region seen during the investigation suitable for cultural operations. The bottom resembles the better parts of the Ceylon Cheval Pár and like the latter premier bank is the largest among its fellows in individual area. It has also a favourable record for rearing its spat to maturity in great abundance. It may not receive so many spat falls as the Karuwal group, but from its superior extent one successful fishery here, is, if it be properly exploited by a sufficiency of divers, worth several of the smaller Karuwal group fisheries.

The Tolayiram Pár should be mapped into blocks in the way in which I have mapped out the Ceylon Cheval Pár (Annexure No. 8) and each of these should be carefully studied, periodically inspected, and the results shown graphically in chart or diagram form annually.

Those parts of this region which came under my personal notice bore but small quantities of loose stony material, "cultch" as it is technically termed, a decidedly unfavourable factor, as the oysters need such material for the purpose of attachment. Attention should in future be given to this detail during inspection, in order to ascertain if this deficiency is, as I think it is, general over the whole area. In the event of this proving to be case means should be taken to increase the available quantity whenever an extensive spat fall is found to have occurred.

Pearl Production—Causes of Death.

Pearl production by the oysters fished in 1889 on the Tolayiram Pár, the only bank regarding which I have any data, was less rapid than that noted during the past two years on the Ceylon Cheval Pár. On some sections of the latter satisfactory pearl production is found at the age of four years, valued at over Rs. 21 per 1,000 in the case of those fished in 1903, whereas the last oysters fished on the Tolayiram Pár were at a similar age valued at but Rs. 3–11–5 per 1,000. It was not till they attained the age of 5½ years that they brought in an equivalent value (Rs. 22–8–6 being the actual average price per 1,000 at the 1889 fishery) to that of Ceylon oysters 1½ year younger. The latter, however, were those from the richest known beds and there were others which at the same age—3½ to 4 years—were not rich enough in pearls to give a profitable fishery. Pearl production is, however, very variable and the yield by one generation is not necessarily a criterion as to what the next may furnish, even upon the same ground.

Examination and comparison of the Tolayiram Pár oysters of 1887–90 with those of Ceylon give fairly satisfactory results in respect to shell growth. They are not equal to the finely grown oysters of the Cheval, but in general appearance are of a healthy type. They are nowise stunted-looking as so many of the oysters on the Párs more inshore are, or, as are the oysters characteristic of the Ceylon Muttuvaratu Pár. But although they are distinctly of the Cheval Pár type, they are of slower growth and the weight of the shells approximated closely to that of Muttuvaratu oysters. Given an abundant infection of pearl-inducing cestode parasites, the pearl production should be profitable in quality and quantity. This question is still one on which we are imperfectly informed; the life-history of the parasite is still unsolved, and till we know the animals which lodge the adult stage, we cannot formulate any plan for furthering the increase in numbers of those of the larval stage, whose presence in the pearl oyster controls the production of valuable pearls.

The ratio of infection—and of consequent pearl production—varies greatly as is to be expected consequent upon the local abundance or otherwise of the host of the adult parasite whatever it may be, and also upon the relative profusion or scarcity of the oysters themselves.

Time after time I have proved by the dissection of large numbers of oysters of the same age from different beds that the cestode infection may vary within considerable limits and as a consequence the pearl yield is proportionately variable. For

example in November 1902 samples of the same generation of $3\frac{1}{4}$ to $3\frac{1}{2}$ years old oysters were obtained from four different beds, with valuation results as follows :—

	RS.	A.	P.	
Periya Pár Karai	13	4	0	per 1,000
South-east Cheval	10	4	0	,,
Mid-east Cheval	18	3	0	,,
North-east Cheval	23	2	0	,,

In March 1887, oysters of a similar age from the Moderagam Pár gave a pearl valuation yield of but Rs. 9–14–3 per 1,000, while other individuals of identical age from the North-west Cheval in the same year were valued as low as Rs. 6–15–0 per 1,000.

Another instance of wide variation in pearl yield occurred in the valuation of the $4\frac{1}{2}$ to $4\frac{3}{4}$ years old oysters fished this year (1904) from the Western Cheval. Three lots varied as follows :—

	RS.	A.	P.	
South-west Cheval	36	0	0	per 1,000
North-west Cheval	33	12	0	,,
Mid-west Cheval	20	4	0	,,

With such wide divergence in oyster value from closely adjoining areas we can never be sure of the pearl yield from a particular bank till we solve the riddle of the pearl Cestode's life-history and are enabled to artificially increase the proportion of infected oysters—a matter for marine biological investigation.

Meanwhile it is satisfactory to know that the oysters which the Tolayiram Pár rears are of fair quality and capable of giving a high pearl yield.

I have had no opportunity to inspect a series of successive generations of oysters from any other Indian Pár. The individuals seen from the Devi, Cruxian, and other inshore Párs appear much inferior to those from the Tolayiram Pár. They are small for their reputed age, stunted in growth, and much encrusted with sponges, corals and polyzoa. In general appearance they approximate to those Ceylon oysters that hail from rocky beds—from the Muttuvaratu Pár and the Mid-west and North-west Cheval.

The Tolayiram Pár is the bank by far best suited to rear healthy oysters in quantity. Unfortunately some of the characters which render it so suitable for this, expose the oysters to heavy risks from the depredations of fishes. The bare level bottom, free from clefts and crannies and boulders, gives the rock-perch and trigger fish (*Vellamin* and *Kilati*) every facility to devour enormous quantities of oysters during the first year of their existence. The bank swarmed with these fishes in May last and the question of the possibility of the present young oyster population coming to maturity depends largely on whether there be many more oysters present than can be consumed by these fishes in nine months or a year. When about one year old the shells become stout enough to resist the sharp teeth of these fishes and the survivors have a fair chance of living the allotted span of oyster existence, if the bank be not harried by a shoal of oyster-eating rays (*Rhinoptera* spp.). These fishes, the principal enemies of the adult oyster, are often of large size, five feet or more across the disc and with mouth armed with milling teeth of great crushing power. They are able to feed only upon comparatively level ground and unfortunately the Tolayiram Pár is of this character. On the Ceylon side, I once walked over an oyster bed ravaged at the most but a few days previously. The sight was one never to be forgotten; everywhere the flat rock surfaces, originally densely packed with oysters, as evidenced by occasional clumps remaining, and by multitudes of torn byssal cables adhering still to the denuded surfaces, were stripped in large part. Wide lanes had been ploughed through, every oyster gone within the breadth of the lane. At frequent intervals lay piles of broken shells, crushed flat as if passed through a mill.

It is a significant fact that this ground is particularly "clean", free from cultch and from any impediment to an animal scraping the oysters off in wholesale quantities. It is ideal dredging ground. Equally significant is the fact that on rougher ground and on areas where bulky cultch occurs, no depredation whatever took place. From this I infer that the presence of fragmentary material is a safeguard against rays; they are unable to differentiate between oysters and rubble when feeding, and when the latter is present, mastication being prevented, the rays find the ground unsuitable and move away.

Hence the cultching of the Tolayiram Pár would serve two purposes of vital importance; it would give additional and much needed holding ground to oysters and would tend largely to diminish the damage liable to result from the inroads of rays.

Much more sediment is held in suspension in the water on the Indian banks than in the case of the Ceylon banks. I do not however consider that this exercises any greatly deleterious effects upon oysters on the outer banks of the central and southern divisions; on the Kilakarai banks the profusion of muddy sediment is excessive, as it also is on some of the inner of the more southern banks, and in such places we cannot expect any spat-fall ever to reach maturity. From the mouths of all the rivers along this coast great amounts of mud are poured forth annually and this in conjunction with the growth of new fringing coral reefs along the shore, each successive one further seaward than its predecessor, causes encroachment upon the sea. The old párs are thus brought more within the harmful influence of river sediment. The process is an exceedingly slow one and the danger to the beds appears greater on paper than it is in reality, even though we know that Korkai, the Kolkhi of the Græco-Romans of 1,800 years ago, and the great pearling centre of that day, is now several miles inland, and its successor, Kayal, converted as well from a flourishing seaport into an inland village.

Again while the presence of so much sediment is harmful, at least to the inshore banks, it has beneficial effects upon the prosperity of the chank-beds, which flourish most vigorously wherever there is a plentiful admixture of mud with the sand, especially if there be much organic matter present, as happens off the mouth of rivers.

To this great abundance of mud is due the superior richness of the Tuticorin chank-beds over those in the neighbourhood of the Ceylon Pearl Banks, where the sand is composed largely of a coarse clean quartz-grit.

Character of the Supervision required.

To place the entire management of the pearl banks under scientific control is the only way whereby the inspection methods can be satisfactorily reorganized and a permanent return to prosperity assured in regard to the pearl fishing industry. I cannot well improve upon the words used in 1884 by the Hon'le Mr. H Sullivan Thomas, then First Member of the Board of Revenue, in his very valuable report to Government on this fishery, namely :—

"I think the deficiencies in the record of facts tend to show that though in "Captain Phipps the Government has had an intelligent and painstaking officer, he "has not been seconded by any scientific supervision anywhere, and that his active "interest in his duties might have been turned to better effect if he had had from time "to time the assistance of some one who had leisure and appliances for adding a "scientific turn to his inquiries. It appears therefore that if the Government contem-"plate ever constituting a fisheries department, pearl fisheries should be combined "with it and have the advantage of any scientific knowledge that department may "have." *

Looking at the matter from a practical point of view, I do not consider that under present circumstances it would be advisable to engage a qualified expert in economic biology to devote himself solely to the care of the pearl banks, even though he be so

* *Loc. cit.*, paragraph 96, page 29.

exceptionally qualified as to be able to combine the duties of marine biologist with those at present performed by the Superintendent-Inspector of Pearl Banks.

To secure a really competent officer, a substantial salary would have to be allotted to the post and, as we know, pearl fishery work can only be carried out on the Madras coast for a maximum of five months in the year. On the other hand, the potentialities of profitable research in other directions are practically unlimited and I think that the time is now ripe, and economic fishery science sufficiently developed, to carry out the suggestion of organizing a Fisheries Department as suggested twenty years ago by the Hon'ble Mr. H. Sullivan Thomas.

If this were done, and an officer appointed as Director, he might be instructed to give his primary attention to the reorganization of the pearl bank inspectional methods, the proper charting and landmarking of the beds, the elaboration of a scheme for the culture of oysters—cultching and transplantation chiefly, the recruitment of an adequate diving labour force prior to any fishery and, if possible, the means for the mechanical raising of oysters by means of dredges and trawls.

Control of the chank fishery should be placed with him. He would elaborate fishing methods, experimenting especially with a suitable modification of the oyster dredge ; if successful, he would take steps to ensure the adoption of such improved methods by the native chank fishers. He would also investigate the feasibility of the artificial hatching and breeding of chanks—a promising departure that opposes few difficulties to success.

Other shellfish of economic value are the Window-pane oyster (*Placuna Placenta*) and the Edible oyster. Large quantities of the former have been fished in a land-locked bay in Ceylon and the lease of this fishery has yielded considerable sums to the revenue in the past owing to the fact that these molluscs yield abundance of seed pearls. In the Madras Presidency they are found in several places in quantity—notably in Pulicat Lake, whereof the great area affords ample scope for the creation of an extensive industry.

Bêche-de-mer is an industry as yet little developed on the Indian coast and one susceptible of considerable enlargement.

In the economic investigation and control of ordinary sea and fresh water fishing, the field for the exercise of the beneficient labours of a Fishery Department is boundless. It is not necessary here to enter on these desirable developments in detail ; I will content myself with pointing out that the fish supply at many localities on the coast of the Madras Presidency might be greatly increased by the introduction of new methods ; that a wide field for remunerative trawling awaits the capitalist on banks as yet scarcely touched by the native fishermen ; that much help could be given to the latter by a fishery expert in teaching improved methods of net tanning and by experimenting with new fibres, such as ramie, for the production of nets cheaper and stronger and of better lasting properties than the materials now in use ; that the cause of public health would be greatly served by the oversight that would be given to fish-curing yards.

A general survey of present fishery methods would be one of the results of the working of the department suggested, and from the facts ascertained it would be possible to consolidate present fishery laws, modifying or enlarging the scope of such enactments as might be found advisable.

The field for improving and augmenting the fish supply from fresh water sources is still more extensive. Practically nothing is done among the natives to improve the quality and the quantity of fish in tanks, a branch of work offering immense scope for well directed cautious efforts. The restocking of inland waters that dry up annually with selected fry of species characterised by rapid growth and good table qualities should be taught, encouraged, and organized on a practical basis. Were this done, the results obtained in other countries and even in some parts of Northern India justify the prediction that the fresh water fish supply of the Presidency would be doubled in quantity and greatly improved in quality within a very short period. Nowhere in the world are the potentialities of aquiculture greater than in India and as yet nothing has been done to utilise modern piscicultural knowledge.

RECOMMENDATIONS.

I. Improved System of Inspection.

(*a*) *The preparation of reliable charts.*—The present charts of the Pearl Bank region are extremely unsatisfactory. The positions of none of the many landmarks dotting the whole length of the Tinnevelly and Madura coasts are shown. It is quite impossible to lay off the ship's position with exactitude upon certain of the banks because of this deficiency; numbers of good marks—chapels, mosques, topes and the like—are in sight, but because their existence has been ignored by the cartographer they are practically useless for the purpose of the inspection of the banks, even actually misleading if we attempt to fix their positions on the coast line and fail, as is probable, in placing them correctly. This lack of beacon indications upon the charts is further adverted to in section *d* below.

The scale of the charts in use—one mile to the half inch—is also too small for careful survey and for the insertion of the necessary details in regard to the distribution of oysters, rock, and sand in the areas inspected.

All the charts used for fishery work should be on the uniform scale of 1 nautical mile to the inch. A 2-inch scale is unnecessarily great and is unwieldy to handle. It is a size especially inconvenient in making comparisons of surveys effected and in furnishing comparative diagrams of oyster distribution to accompany the periodical inspection reports.

In the past there has been unnecessary sub-division of the potential oyster-bearing area, resulting in the creation of 64 so-called banks. Many of these are extremely small patches of rocky bottom often not more than half a mile long by a quarter in breadth. Many again lie adjacent to one another and hence lend themselves readily to a system of grouping. I propose therefore a grouping of the banks in the manner shown upon charts C and D (annexures III and IV).

Each group may be denominated by the name of the best known bank included. The grouping suggested is that which has been detailed fully in the section dealing with the topography of the banks (*vide ante* p. 24) and which need not be here recapitulated.

Accompanying the revised working chart, which should be put in hand at the earliest opportunity, should be a list of at least three cross bearings taken from the central point in each inspection circle (see *infra*).

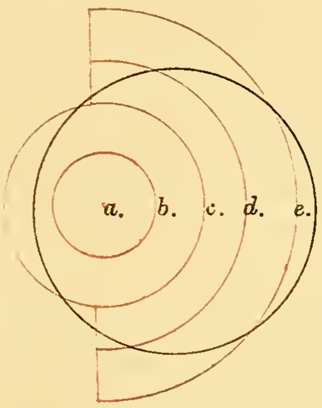
(*b*) *Adoption of a system of detailed "Circle-inspection."*—To ascertain the presence and distribution of oysters over the whole of the effective Pearl Bank region, an exhaustive examination by what I term "Circle-inspection" is absolutely essential.

Any bank found bearing oysters should be inspected by this method so long as they remain, and all hitherto unexamined ground should be covered with a net-work of tangent circles to ascertain the distribution of rock and sand and the potentialities of oyster-bearing.

Picked divers should be employed for the work and the services of the same men secured permanently by giving them either an annual retaining fee or an extra rate of pay. They should be placed under the charge of four inspection coxswains, also on a permanent engagement for the annual inspections in the same way as has been adopted with marked success in the Ceylon service.

The banks grouped as suggested in the preceding section should next be mapped out into circular inspection areas which may be termed "Inspection-circles", of $1\frac{1}{2}$ mile in diameter, each denoted by a serial number and, where it can be done with advantage, by a distinctive name. The larger banks, like the Tolayiram and Manapad Párs, will require several circles to cover them, whereas in the case of the smaller párs several will frequently have to be grouped within one circle. In the latter case, the circle for convenience may take the name of the largest or most important of the included párs; in the former from its compass bearing. For example the four divisions of the Tolayiram Pár may be denominated respectively the north, the central, the south, and the south-west sections, while the circle including the Karai Karuwal and the Velangu Karuwal Párs may be termed simply the Karuwal section or circle.

During examination the inspection vessel should moor as near the centre of each section as possible, and if to one side, modify the outer boat circuits to suit this as shown in the accompanying diagram.



The black circle is the outline of the Pearl Bank section to be examined—

(a) The ship's position.
(b) The ¼ mile circuit.
(c) The ½ mile circuit.
(d) A ¾ mile semi-circuit.
(e) A 1 mile semi-circuit.

With good landmarks, reliable compass, and painstaking endeavour it should not be difficult to anchor with approximate accuracy upon the centre of each section.

The banks of superior value lie from south of Vembar to off Manapad, the Devi Pár being the most northerly, the Manapad group marking the most southerly limit.

Charts C and D (annexures III and IV) show the inspection sections which I propose. They are based upon the Pearl Bank chart at present in use and which in turn is based upon the Admiralty Chart of this part of the coast.

Each of the circles, of which there are 35 according to my arrangement, is marked with its own distinctive number. The inspection of each circle should be completed in one morning, leaving the afternoon wherein to lift the twelve mark-buoys, shift the inspection vessel, locate the centre of the next circle, and to lay out the buoys for the following day's work.

Given average fair weather, such an inspection would occupy six weeks.

If the weather be favourable and other circumstances allow, I recommend that the whole programme be completed in one season, in which case, should the results show no considerable deposit of oysters to be present, the inspection of the following year may be greatly curtailed and be in the nature of traverse prospection rather than detailed circle inspection. Circle inspection and zigzag prospecting may be used in alternate years, but wherever oysters be found in quantity, detailed circle inspection with careful numerical estimates should be carried out annually. Where oysters of over 2½ years of age are known to exist, inspection should take place if possible *twice* a year and a valuation sample drawn at the age of 3½ years and thereafter twice annually until such time as the valuation amounts to over Rs. 10 per 1,000, whereupon it becomes incumbent to consider whether or not a fishery should be held at as early a date as possible.

Details of the method of circle inspection.—The essential features may be stated as follows:—

Three flag-buoys are laid out by the attendant launch or tug-boat in the direction of each cardinal point of the compass at distances apart of a quarter of a mile, the inmost buoys taking their distance from the inspection vessel, which is anchored to serve as a pivot mark in the centre of the area to be inspected.

Four inspection boats (modified whale boats), each manned by a crew of six, together with three divers and two munduks, under the charge of an experienced coxswain, take up equidistant positions between the ship and the first buoy on the north line and row slowly round the ship, retaining their relative positions the while. At regular intervals the crews rest on their oars to allow the divers opportunity to make descents. The result of each dive is reported to the coxswain of the respective boat, who records it upon a diagram with which he is provided.

The four boats having each performed a complete circuit are next ranged in line abreast in the same manner as before, between the quarter and the half mile buoy and each makes a second circuit. The day's work is completed by a third and last circle, in this case between the buoys distant respectively half mile and three-fourth mile from the ship.

The four boats make a total of twelve concentric circuits, each boat making three. The results shown upon the coxswains' diagrams—each of which has three concentric circles drawn upon it (see plan No. V) representing the three circular paths covered—are transferred by the Inspector to a final diagram or plan furnished with twelve concentric circles. When this has been done the distribution of old and of young oysters is graphically shown for a circular area having a diameter of a mile and a half (plan VI).

After calculating in square yards the area occupied by oysters the approximate number thereon may be estimated by taking the average number of oysters per dive (ascertained by scrutiny of the divers' results) in conjunction with the average amount of ground which a diver is credited with being able to clear at one descent. Usually this area is considered on average ground to be from two and a half to three square yards. By assuming the area per dive to be three square yards the danger of an overestimate is avoided.

(*c*) *Purchase or charter of an inspection depôt ship.*—To carry out inspection satisfactorily I recommend that either a schooner be built, purchased, or chartered, to serve as the head-quarters or depôt upon which the inspection staff of divers and boat men may live.

If purchased or built specially, the latter of which would be the more economical and satisfactory plan in the long run, cooler and more commodious quarters could be fitted up than upon a steamer, and being wooden there would be practically no liability to error in the accurate taking of compass bearings.

A steam vessel would be required for towing purposes. The "*Margarita*" might be used for the present and when it becomes necessary to replace her, the next vessel should be a screw steamer built and fitted specially for dredging and towing so that when not engaged in the latter duty, she might be used for the dredging either of chanks or of fishable oysters for market and for valuation sample.

Meanwhile the "*Margarita*" should be altered and fitted to serve dredging purposes for which she is by no means unsuited.

(*d*) *Beacons to be charted and improved.*—An improved scheme of landmarks should be provided and the positions of the several beacons accurately fixed on the chart. It is almost incredible that none are marked on the charts in use; the Inspector has to roughly guess their relative position to the headlands and indentations of the coast indicated on the chart. Even the Admiralty Chart, which is wonderfully accurate in other respects, shows the position of but a very few with precision—the others either being omitted or not defined with exactitude. In taking bearings from the sea, it is of little value to see upon the chart a number of marks at a certain spot indicating the presence of a conglomeration of buildings; we require the position of the most conspicuous one to be placed with precision.

The beacon on Vantivu should be increased in height and an additional one erected on one of the islands to the northward.

(*e*) *Improvements in recording the details of inspection results.*—The officer in charge of the Inspection of the Pearl Banks should be directed by the Government to insert in the records kept in his office as well as in the report furnished by him to Government at the termination of each inspection, the following details concerning the condition and abundance of the pearl oysters and associated organisms met with on each of the inspection sections, namely :—

(1) The number of individual dives made upon each group of párs, and the number of those where oysters were found, together with the average number of oysters per dive over the whole of the productive ground. Not less than 300 dives should be made upon *each section*, if a reliable conception of the character and condition of the area under examination is to be arrived at. The number of dives made upon the banks in the past, even upon the important Tolayiram Pár, have been totally insufficient. The Tolayiram Pár is of such large extent that four inspection

circles are needed to cover it adequately, equivalent therefore to a total of 1,200 dives. From the office records I notice that in 1890, ninety dives were made; in 1892, 158 dives; in 1896, 220 dives—far too few to give a reliable conception of the condition of the bank as a whole.

Other banks fared even worse. Taking some figures at random I find that 12 dives were made to suffice for the Alluva Pár in 1886 and 32 in the following year. On the Tundu Pár 35 dives were made in 1885, 31 in 1887, 7 (!) only in 1889. On the Karai Karuwal Pár, one of the most frequently productive of the Indian banks, a sorry seven dives sufficed for the examination of 1888, while the Velangu Karawal Pár had 74 dives in 1887 and 63 in 1891.

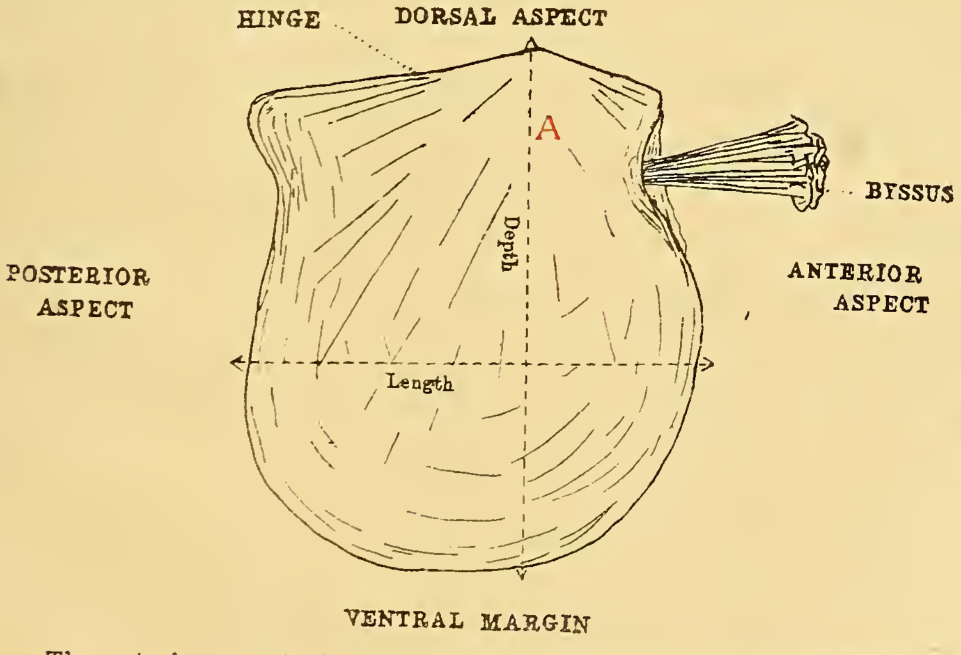
(2) The average weight and dimensions of an average sample of the living oysters found in each locality should be recorded with exactitude. Where the oysters are numerous, the sample should be as large as possible to diminish the possibilities of error. The weight should be recorded in pounds, ounces, and drams, and where possible 100 oysters should be weighed together. In expressing the average weight of the individual oyster it might be useful to express the result in grammes, as the metric system is more convenient for the purposes of comparison than avoirdupois weight.

When there are large numbers of oysters present and possibilities of an eventual fishery, the cleaned (empty) shells of 25 individuals should be averaged in like manner.

I think it probable that we shall eventually find the average weight per shell the most reliable guide in ascertaining whether growth be satisfactory or not and also in ascertaining the approximate age of oysters of unknown history.

In the same way I recommend the dimensions to be recorded in centimeters and millimeters, recording the length, depth, and thickness of 25 individuals taken haphazard and without selection from the samples brought in by the divers.

The length is the greatest horizontal distance between the anterior and the posterior margin of the shell taken parallel with the hinge-line, as shown upon the accompanying diagram. The depth is the longest line that could be drawn (measured) at right angles to the line of greatest length; it extends from the hinge to the most ventral point of the free margin of the shell.



The anterior aspect of the shell can readily be distinguished as such because of the presence of the byssus at that side.

The thickness should be measured by means of a pair of callipers, clasping the jaws upon the thickest part of the oyster, a point indicated in the diagram by the letter A.

(3) The general outward appearance, stunted or of free vigorous growth, should be stated and also whether the oysters be extensively covered or not with sponges and other crusting organisms in exceptional degree.

(4) The comparative abundance of the following animals should be noted, so far as it is possible to ascertain the facts :—

(*a*) Chanks (with a view to utilizing this knowledge in further exploiting the chank fishery).
(*b*) Starfishes (especially the scarlet-lake coloured *Pentaceros lincki*, a great enemy of the pearl-oyster).
(*c*) Rockfishes and Trigger-fishes (*Vellamin* and *Kilati*).
(*d*) Sûran (*Modiola barbata*).
(*e*) False-spat (*Avicula vexillum*).

The abundance of sea-weed might also be recorded.

Charting the results.—Each of the four Inspection Coxswains should fill up, each day that circle inspection be employed, a diagram form similar to that shown in annexure V, while the Inspector should the same day transfer to a master—form (annexure VII) provided with twelve concentric circles, the information contained in the diagrams furnished by the four Coxswains.

By this means he will be enabled to lay down the extent of the rocky bottom present, and later, when the entire inspection is complete, the outlines of these areas of rock should be filled in upon a skeleton chart. The final results, if carried out with care and accuracy would provide material, in the course of a few years' work, sufficient to enable a revision of the Pearl Bank chart to be undertaken, in respect of the pár outlines or boundaries.

The resultant chart would then indicate the rocky areas which remain comparatively free from sand from year to year, *i.e.*, the mean distribution or exposure of rocky bottom during normal seasons. If the distribution of oysters be also shown upon another similar skeleton chart, comparison of a series of these with the rock distribution chart would show if any part of the sandy areas frequently bear oysters, and what parts, if any, bring their oysters to maturity most regularly.

Further and much needed light would also be shed upon the relative value of different sections and would lead probably to a concentration of effort upon certain patches, while others might be found so uniformly unprofitable as to be ignored thereafter, whereby time would be economized or devoted more usefully to the more favourably situated párs.

The Inspector, when he furnishes his periodical reports, should accompany it by the two charts named—one showing the distribution of rock and sand over the ground examined, and the other that of the distribution of oysters, a separate colour being used for different ages, the average size being given of each age.

Copies of these charts should be kept in the Inspector's office, and bound into permanent form every few years for the purpose of future reference.

II. Regulations affecting the Capture of Fish upon the Pearl Banks.

Whenever a large deposit of young oysters be found on any of the párs, if there be little sûran present, I recommend that encouragement be given to fishermen to go there and fish for Vellamin and Trigger-fish (*Kilati*) as these are the great enemies of the pearl oyster at this age.

Stone anchors should, however, be interdicted, and the use of grapnels or iron anchors insisted on.

At other times, except when the pearl oysters are in their third year, I should recommend fishing to be permitted with the one restriction regarding the non-employment of stone anchors.

When oysters on a bank approach maturity probably it would be advisable to prohibit fishing—this chiefly for two reasons, the one being the danger of disturbance of the oysters, and the other that at this time sponge-eating fish (*Holacanthus* spp.), Gymnodonts, Vellamin (*Lethrinus* spp.), and Trigger-fish perform a useful function in devouring and helping to keep under various competing organisms, sponges, small molluscs (sûran and brood oysters), and crusting growths that overload and overrun the valves of the older oysters.

III. Determination of Surface-drift over the Banks.

An accurate knowledge of the movement of the surface-water over the pearl banks is a matter of the utmost importance in their management. Without this knowledge we cannot form even an approximately accurate idea of the source whence comes the spat that from time to time replenishes one or other of our banks. So long as we are in the dark upon this subject, we cannot define in what location a reserve of oysters should be to produce the most useful results. There are banks so situated as to be normally of no breeding value, of no importance in replenishing the banks which are our reliance; conversely certain banks must be of supreme importance in the conservation of our beds, and it is obvious that information on these points is of vital importance in the farming of the banks. It should be ascertained whether any proportion of the spat that settles, say on the Tolayiram Pár, originated from the oyster beds on the Ceylon side of the Gulf of Mannaar, whether the converse be the case, or again whether there be mutual interchange of spat.

The plan offering the greatest advantages is to obtain the co-operation of the Ceylon Government in order to secure both uniformity of method and mutual assistance in carrying on this investigation. I recommend that batches of small sealed bottles, each containing a post card inscribed in English and Tamil, be thrown into the sea, at intervals and places yet to be determined, on both the Indian and the Ceylon side of the Gulf of Mannar, and that small rewards be given to those finders who place the cards in the hands of the nearest revenue officer or native headman, who would despatch them to the authority appointed, with particulars of the date and place of recovery.

After investigation on these lines has been carried out systematically for two or three years, it will become possible to determine the place of origin of much of the oyster spat, and we shall be enabled to trace the course of its wanderings while in the larval swimming condition, and in consequence know where to conserve breeding reserves of oysters for the further replenishment of the banks.

IV. Culture of the Banks.

(*a*) *and* (*b*). *Transplantation and Cultching.*—The principal means whereby the banks can be permanently improved and the quantity of fishable oysters increased lies in the adoption of the correlated operations of cultching and transplantation of young oysters. The latter is admittedly the most important cultural means at our disposal for increasing the harvest of the pearl banks and I am of opinion that it might be adopted with very favourable financial results on certain of the Tuticorin banks, notably upon the Tolayiram Pár, provided there be proper organization of the diver labour-force, so that when the oysters become of fishable age we may be assured that the means will be adequate to bring the greater part of them ashore during the limited available season of favourable weather.

If this long-standing labour difficulty be removed I advise the fitting up of the inspection steamer as an oyster dredger in order that, when young oysters are found in profusion upon unsuitable ground, a substantial proportion may be transferred to a bank where the conditions are favourable to the maturing of oysters. My experience with the Ceylon dredging steamer "*Violet*" shows that from 500,000 to 700,000 oysters of the size attained in six months, may be transplanted during each day's employment, equivalent to a transplantation of from 15,000,000 to 20,000,000 per month—extremely satisfactory figures.

The Tolayiram Pár is a suitable bank and there I should advise the laying of any oysters lifted from other localities, as it is in many ways the best for this purpose. It has, however, the great defect of possessing an insufficient quantity of loose stony fragments spread over the major part of the surface. To fit it to receive and protect the oysters transplanted there to and to give satisfactory fishery results, I recommend whenever transplantation is in operation that several hundred tons of broken coral obtainable from the reefs fringing the coast in many places, be spread over the bottom where the transplanted young oysters are laid. The cost would be comparatively small, as coral collection is a local industry at Tuticorin and as the laden ballams and dhoneys would proceed direct from the Hare Island reef to the bank, where their cargoes would be scattered over culture areas marked out by means of flag-bearing buoys.

(*c*) *Cleaning of the Banks.*—In this, as in the matter of cultching, we may with the greatest advantage profit by the experience of European oyster-culturists, who find it absolutely necessary to check the growth upon the banks of all organisms other than oysters. Not only must those that are active enemies of the oyster (starfishes, whelks and the like), be destroyed, but also those animals that curtail the area that oysters may occupy, and which also consume food that would otherwise fall to the oysters. Sea weeds too are ruthlessly rooted out. As a consequence much of the oystermen's time is taken up in cleaning the beds by means of the dredge. If the beds are in preparation to receive spat, all harmful matter is taken ashore—starfishes, whelks, mussels, and the thousand and one animals that may be termed the passive enemies of the oysters—where it finds a ready sale as manure. Sea weeds share the same fate, while all solid material that is overgrown with any form of life is regarded as "foul", and laid out on the beach to be cleansed and bleached by the combined influences of sunshine and rain.

Unfortunately many of the Tuticorin banks, the Tolayiram Pár being a notable exception, are more or less "foul". Sponges, corals, alcyonarians, echinoderms and ascidians abound on nearly all the inshore párs, as for example, the Uti, Uduruvi, Kilati, and Kudamuttu Párs and such oysters as live there are stunted and poor, suffering by competition with the host of creatures living upon the same diet of microscopical organisms.

The only means to clean a bed is to dredge it thoroughly, separating and treating the materials brought up in the way above described.

The Indian banks are too extensive to permit of dredging being undertaken with this sole object in view, but, as this cleansing can and should go on concurrently with the dredging of spat for transplantation or of mature oysters for sale, we have herein one of the chief arguments in favour of taking up dredging on a scale of considerable magnitude. Sight should never be lost of the fact that dredging has four-fold utility, namely, (*a*) fishing oysters, (*b*) cleaning ground and removing enemies, (*c*) in thinning out overcrowded beds, and (*d*) spat transplantation. Its value is not properly assessed if account be taken of the first item alone or even of the first and the last.

Every live coral removed and replaced by a fragment of clean cultch may mean the addition of three oysters at the next fishery; every starfish destroyed *does* mean scores of oysters saved from destruction; every Clione-riddled block of coral bleached on the shore will tend to reduce the widespread havoc this inconspicuous sponge causes amongst the oysters. The immense advantage that accrues from keeping the banks in a state of thorough cleanliness can well be appreciated by an agriculturist who knows how his crops fall off if weeds be allowed to run riot unchecked, if fungoid and insect pests be ignored, if the soil be never disturbed and if sun and air be excluded therefrom.

(*d*) *Thinning out of oysters.*—The evil effects attendant upon overcrowding of the oysters which so often takes place upon certain of the Indian banks have been laid stress upon, and I think sufficiently demonstrated. The remedy suggested consists of thinning out at suitable time. The dredge again is the only remedial agent. Thinning out, transplantation, and cleaning the bank may all proceed conjointly—the thinned out oysters being deposited on unoccupied ground, while the foreign organisms and the cultch materials will be taken ashore, the former to be destroyed, the latter to be bleached.

V. Creation of a Fisheries Department.

A Fisheries Department should be constituted under scientific control and the work of inspection of the pearl banks and superintendence of the chank fishery transferred thereto as the most important duties under its control.

Such a plan would enable these two important departments to be developed economically and on sound practical lines, would enable attention to be given to the development of other fishing industries, marine and fresh-water, at present under no scientific supervision, and finally would set free the Port Officer at Tuticorin from work foreign to the important duties involved in the charge of the port and harbour of Tuticorin, which would then receive his undivided attention.

Ceylon,
February 1905.

JAMES HORNELL,
Marine Biologist to the Govt. of Ceylon.

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APPENDIX A.

AN ACCOUNT OF THE CONDITION OF THE COAST OF MADURA AND OF THE PEARL FISHERIES THERE IN THE YEAR 1663, TRANSLATED FROM VALENTYN'S "HISTORY OF THE EAST INDIES", VOLUME V, PAGE 164.

" 1663. *Madura.*—Under the Coasts of Madura are included the seven ports or harbours, and the country of the Prince Ragonada Catta Theuver, commonly called the 'Teuver,' with whom we are on good terms. His contract, written on copper, is hereunto annexed. But we consider a further description necessary of the Gulf between Ceylon and Manaar, and we shall commence with the island Ramanacoil, which is in the inner Bay, and makes a narrow separation between the Continent of India on the one side and Adam's Bridge on the other, but the passage, with the highest water towards the land is scarcely six feet deep. This passage is called Pamben-aar, signifying, on account of its many windings and curlings, the 'Snake River' which gives the Theuver sufficient profit not only from the tax laid upon the Pass, but also on account of the excursion over to the Island, on which there stands a very old pagoda of their much revered idol Ramana, to honour whom people come from Hindostan, Orissa and Bengal, from which circumstance it may well be imagined that a tolerable revenue is derived.

" This said Teuver is subject and tributary to the Naick of Madura; but since we have entered into terms of alliance and friendship with him, he cares far less for the Naick than he did previously; but he greatly respects us, knowing that it is in our power to take this island of Ramanacoil from him, and therefore we can always retain him to our interests, as a balance against the great power of the Naick, although it is not by any means requisite that we should show any great deference to either the one or the other.

" The western lands of the Theuver are situated next to Ramanacoil, farther eight or ten miles in the Gulf, within which lie his principal places on the sea-coast, named Wedale Peripatnam, Killekare and Wallemoeke, over which we have no authority. But still farther to the west follow By-paer, Bem-paer, Pattenemandoer, Tœtecoryn, Pondecail, Cailpatnam and Manepaar, constituting the 'Seven Harbours,' all (excepting Cailpatnam, whose inhabitants are prineipally Moors) being inhabited by Christian Parruas, and provided with commodious churches. The number of these Christians consist at least of 20,000 families, maintaining themselves chiefly by diving for chanks, catching fresh fish, and diving at the pearl-fisheries when they take place, and which last employment gives them their chief profit, and causes them to live comfortably. These Parrua Christians are all under the Government of the Honourable Company, since the conquest of Tutucoryn, and they have readily submitted to our power on account of the prompt justice which we afford them. The poorer classes are more especially well satisfied with our Government.

" Great care should always be taken to treat the people with justice and prudence, and to place a mild and sensible person as their Captain, for they are, like all Malabars, of a capricious temper and easily migrate if they are not well treated. We have used great efforts to bring the people to our religion, but as long as the Naick of Madura, or his regent Barmiliappa Pulle do not adopt a course different from their present one, and do not specially banish the Romish priests, we shall have little chance of attaining our object.

" *Pearl Fishery.*— The whole of the inner gulf was always under the authority of the King of Portugal, during the time of his possessing Ceylon and Tutucoryn, and on that account the Portuguese always took to themselves the full empire of the sea, including the income of the pearl-fishery, which is of some consequence, particularly when diving can take place on all the banks at once, as used frequently to be the case; but for some time the banks of *Mannaar* have given no profit, although the revenue from them was once the most considerable, and it is now fixed that they should be tried next March. But as there is some distinction with regard to the Company's interests between the banks of Tutucoryn and those of Manaar, we must give a further account of them. Whenever the pearl-fishery is limited to Bempaer, Bypaer, and as far as Tutucoryn, all the oysters must be brought ashore at the last place, the market being held there and at Pondecayl, from which the Armane (as the Court of Madura is named) draws a large revenue. The Moors are, with our permission, allowed to fish also, but they are bound to pay a large duty to the Company as may be seen in the Report of M.M. Valckenberg and Boesem.

" The fishery of Tutucoryn gave last season a profit of 18,000 florins, as appears by the books of our factory at that place. Whenever a pearl-fishery may take place at Man-aar, the Company may expect much larger returns, for then the oysters will be brought ashore at Aripo, about three miles distant from Manaar, or Mantotte, being a place on the Company's own territory, and where the sale of the pearls will then be held. Y.E. should take care that a guard be stationed, to watch against irruptions of the Wannias, Wedas, or King's people, and in order to give confidence to the divers for themselves and their boats. If there are 100 soldiers and 100 lascoryns, the guard will be sufficiently stroug, if Mauaar aud Jaffnapatam have their garrisons also strengthened."

(From the Memoir left by Governor van Goens for the guidance of his successor Governor Hustaart, 26th December 1663.)

APPENDIX B.

DETAILED FINANCIAL STATEMENT OF THE CEYLON PEARL FISHERY OF 1694.

(TRANSLATION FROM THE DUTCH OFFICIAL RECORD.)

Free Stones of the Naick of Madura, The Theuver, The Pattangatyns of Jaffnapatam, Manaar and Tutucoryn, according to old Customs.

	Rds.	Rds.
96½ different free stones of the Naick of Madura in six boats, viz. :—		
4 Christian stones, at 6½ Rds. each	26	
1 Gentoo stones, ...	9	
91½ Moorish stone at 11½ Rds. each	1,052¼	
		1,087¼
60 Moorish stones in three boats for the Theuver (of which 1 is given to the Maniagaar of Pambenaar) at 11½ Rixdollars each	690	
		690
9 stones to Pariboe-neyna, Head-Moorman, viz. :—		
7 Christian stones at 6½ Rds.	45½	
2 Moorish do. at 11½ ,, ...	23	
9		68½

The following to the Pattangatyns of Jaffna and Manaar :

43 stones, namely :—

10 for the Pattangatyn Moor of the Parruas of Mannnaar, Jan de Cruz.
10 to Anthony de Melho, Head Pattangatyn of Carreas.
8 to the Nayenkarreas, namely :
- 2 at St. Pedro.
- 2 at Pesale.
- 1 at Tellemanaar.
- 2 at Ikelampalle or Lugaar.
- 1 at Aripo.

8

3 to the Pattangatyn of Jaffnapatam, Don Rodrigo.
3 to the Pattangatyns of the Carreas.
3 to the Pallewellys.
3 to 3 General Pattangatyns of Parruas, Carreas and Pallewellys.
1 to the Head Moorman of Jaffnapatam.
2 to the Pattangatyns' Canacapulles.

	Rds.
43 at 6½ Rds. each	279½

181 stones to the Pattangatyn of Tutucoryn, viz. :—
130 to Pattangatyns, 1 Canacapulle and the Topas Moorman, each 26 stones.
6 to 2 Head Pattangatyns.
3 to 3 Canacapulles of the Community and of the Pattangatyn Moorman.
1 to the Bazaar Guard.
1 to the executioner.
40 to 40 common Pattangatyns of the seven harbours.

	Rds.
181 stones at 6½ Rds. each	1,176½
Total 389½ stones valued at Rds.	3,301¾

FINANCIAL ACCOUNT OF THE PEARL FISHERY OF 1694.

DR.

	RXDS.		FLORINS.		
Expenses for the inspection of the pearl banks at various times from the year 1667 (2nd Fishery) to 1694 (3rd Fishery) as appears by the books kept at Manaar			6,767	16	5
To expenses incurred for the same purpose at Tutucoryn, as appears by the commercial books of that place and of Manaar			2,493	1	11
			9,260	18	0
Expenses at this fishery, namely, expense of soldiers and sailors, lascoreens, cooly hire, arrack, medicine, and sundry expenses of the Commissioners according to their separate account ...	1,709	=	5,217	13	0
Cost of $389\frac{1}{2}$ free stones, which according to old custom are not paid for — see separate account.	$3,301\frac{3}{4}$	=	9,905	5	0
To the Shroffs who counted and sorted the money and prepared it for being paid over	40	=	120	0	0
+ Clear profit			63,057	13	0
Total ...		florins	87,561	9	0

CR.

		RIXDOLLARS.
The amount of the rent of the 'change,' of the bazaar, and of the clothes shop, viz. :—		
The 'change'		1,500
The Bazaar		137
The Clothes		31
		1,668
Stones purchased in the fishery and paid for, namely :—		
1,690 Christian stones paying $6\frac{1}{2}$ Rds. each ...	10,985	
204 Gentoo do. do. 9 do. ...	1,836	
1,268 Moorish do. do. $11\frac{1}{2}$ do. ...	$14,242\frac{3}{4}$	
		$27,063\frac{3}{4}$
Customs formerly collected by the Topas-Moor of Tuutcoryn, but now taken by the Company and held at the disposal of the Governor and Council of Colombo		
201 Gentoo stones at 1 fanam each	$20\frac{1}{10}$	
1,014 Moorish do. 2 do.	$202\frac{4}{5}$	
		$222\frac{9}{10}$
12 ounces, 17 angels, and 3 as of pearls gained from oysters brought up by the divers of the Company as Wally, sold for	180	
Sifting the sand where the pearls were laid ...	25	
		205
$13\frac{3}{4}$ ammonams of concealed arrack found in the bushes and out-of-the-way places at 6 Rds. the ammuna	$82\frac{1}{2}$	
Deduct two-thirds given to the discoverers of the arrack	55	
		$27\frac{1}{2}$
Total ...	Rds.	$29,187\frac{9}{60}$
or	fl	87,561 9 0

Thus drawn up in the Fishery to the S. of Aripo, 7th May 1694.

(Signed) FLORIS BLOM,
(„) A. BERGAIGNE,
(„) D. DE CHAVONNES.

APPENDIX C.

INSTRUCTIONS GIVEN IN 1722 BY THE GOVERNOR OF CEYLON DEFINING THE RESPECTIVE RIGHTS OF THE DUTCH, THE NAYAK, AND THE SETUPATI AT PEARL FISHERIES HELD IN THE GULF OF MANNAR.

*Extracts from a despatch, dated 20th January 1722, from the Extraordinary Councillor and Governor of Ceylon, M. J. A. Rumpf, and his Council in Colombo, addressed to the Senior Merchant and Chief Authority at Jaffna, Jacob deJong, and his Council there.**

"It is now upwards of 22 years since the Company has indulged its own subjects or strangers with any fishery in the Bay of Condatchy.

"The Valy, or general fishing on the Company's account, is together with the payment for the stones, a double token of the Company's sovereignty over the divers and the Banks from Cape Comorin, north, to Negombo, south; or at least by these tributes enough is done to show the dominion conceded to the Company over those seas, the bay and the pearl-banks lying there, and the result of the enquiry of the Commissioners for the last three years proves that this claim is indisputably made with greater foundation than that of the Naick to the ships along the coast of Madura, when that Prince, to show his mixed authority, sets up his flag next to the Company's standard at the fort of Tutucoryn, assists in laying down rules for the fishery, exercises magistracy over the black people who come to that fishery, permits all misdeeds, except treason, to go unpunished among his own subjects during the time of fishing, and the Company winks at this and receives tax from all pearls carried away from Tutucoryn, but with the exception of 96½ free stones he has no part or share in the produce of the stones sold at the Banks of Madura or Aripo, which payments are received and kept solely for the Company as Lords of these seas and bays; but at the same time (though it appears rather unreasonable) from old custom, a kind of authority is exercised by the Naick over the Champanothy of every nation, which obliges them to give to this Prince of Madura one day's fishing free of payment, but His Highness, through his ambassadors who came to the fishery of Condatchy, has now and then endeavoured and more especially in the year 1695, according to the custom of all black people, to institute a claim to enjoy the same tribute from all dhonies, but this has always been boldly refused to him, except with regard to his own subjects from whom he takes this tribute, as the Theuver does from his own subjects, but no further as the Commissioners will find fully explained in the reports of 1694 and 1695, where the Company's absolute and undivided authority, if not along the coasts of Madura, at least in the Bay of Condatchy as being Sovereigns there, in the same way as this is given to Princes on the coast of Madura, etc., etc., etc.

"The Maniagaars of the Armane and Theuver, as envoys sent to take care of their masters' interests in the Fishery of Aripo, must be treated with politeness and cordiality. The olas which they usually bring with them must be received and forwarded to me, and nothing must be granted to them except what is authorized by old custom, viz., to the Naick 96½, and to the Theuver 60, free Moorish stones, as appears by the lists which I mentioned to you, although the latter Prince, being limited to three boats, was accustomed to have an unequal number of stones in them, which gave rise to frequent disputes; until at last in the year 1694 it was stipulated that whether the boats were large or small no more than 60 stones were to be employed in them, which you will unreservedly take notice of; and if any claim be made, you will refer to this rule laid down in 1694 and followed till 1699. *And as to his request of 27 free stones for the Pagoda of Ramanacoil, His Excellency may give as much as he pleases from those 60 stones which are granted to him from the Valy which he receives from his own subjects*, but the pretensions of Peria Tamby, or whoever now fills his place as the Theuver's Marcair, seem better founded. This claim is not a rule, but an act of liberality on the part of the Company, and granted or not, in proportion to the care and favour which he gives to the Company's trade at Kilikerry," etc., etc.

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* Ceylon Literary Register, Volume III, pp. 166, 167.

APPENDIX D.

1744. ADVANTAGES TO BE GAINED BY GOVERNMENT BY RENTING OUT THE PEARL FISHERIES OF THE GULF OF MANNA .R

Respectful considerations relating to the renting out of the Aripo Pearl-Banks and the Chank Fishery on the shores of the North of Adam's Bridge, submitted to His Excellency Gustavus William Baron Van Imhoff, Governor-General, and the Members of the Council of Netherlands India, by Julius Valentyn Stein Van Gollenesse, Governor of Ceylon. (Ceylon Literary Register, Volume III, page 181.)

Although the undersigned has not as yet acquired sufficient experience to be able to judge fully of all matters relating to the Pearl Fishery, yet he is unwilling to defer obeying the order conveyed in your letter of 5th November 1743,* and which desires that he should lay before you his humble opinion with regard to the Chank Fishery, and also state whether it would not be as advisable, or even preferable to rent out the Aripo Pearl Banks, as to continue the present custom of settling whole or half fisheries, and he hopes that Your Excellency will look over any errors in his views of the subject, and kindly supply any defects in this statement of his opinion.

In the first place then, I must admit, as a matter beyond dispute, the remark which Your Excellency makes in the memoir left here for the guidance of your successor in this Government, namely that the Honourable Company is rather a loser than a gainer in our Pearl Fisheries; no person will deny this who has a grain of local knowledge respecting the affairs of Ceylon. It is therefore necessary to seek some mode of conducting these fisheries, which may secure to the Company the profit to be derived from them without its being accompanied by the many drawbacks detailed in your memoir; and who can doubt that this may best be effected by renting them out, or by selling the freedom of diving on the banks, with a limited number of boats and persons in the same manner as now takes place with regard to the Chank Fishery. It is evident that this may be done without any hindrance, and more profit will result than is expected, at all events the gain will be real and not merely ostensible. It is not to be denied that at first sight some difficulties appear to rise in opposition to this plan, but the undersigned will now relate everything that to the best of his knowledge can offer hindrance, and show how in his opinion every obstacle may at once be removed.

I. The Theuver and the Naick of Madura having had from all times three days free diving in each fishery will not allow this privilege to be taken from them.

Answer 1 (*a*)—This privilege seems to have been merely conceded because the greater number of the dhonies and people required at a public fishery come out of their country, and these will not be required if the diving takes place with a limited number of persons; the right may therefore be withdrawn.

(*b*) If they venture to pretend that their right rests upon a better ground, and cannot therefore so easily be withdrawn, it is certain that on the other side they have never fulfilled that portion of their concessions which are laid down in legal contracts between the Company and themselves and the Company is therefore fully authorised to deny their right, even if it can be called by that name.

(*c*) If there remain any doubt that this can justly be done, yet this need not prevent the rentings, as their privileges may still be guaranteed to them under proper restrictions.

2*nd Objection.*—It will be difficult to find persons of so much property as to pay the price of the rent in advance.

2*nd Answer.*—Even if they be not found in this island, speculators enough will come from the coast, and even money enough exists among the Ceylon merchants, for many together will make a Company to take shares in the adventure.

3*rd Objection.*—Even though the number of the dhonies be limited speculators will arrive from all sides, and there will be as large a crowd of persons to purchase the pearls as ever there was at an open fishery, and then the Company will not obtain its purpose in this respect.

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* Merely calling his attention to the preceding remarks of Baron Van Imhoff.

3rd Answer (*a*).—It is very different from an open fishery which is proclaimed on all sides, and to which all persons are invited, but in a rented fishery it would only be necessary to give orders that no person should be admitted except those who are absolutely required to be present, and the uninvited might be sent away.

(*b*) The oysters might be opened on the shore by the renter's people, and might be taken away at pleasure, but if it be imagined that this would bring too great a concourse of people to this island, it would be easy to order the renter to take away the oysters with him to the coast, as is done with the Chanks, and not to allow him to land them on this side the water.

4th Objection.—For a complete fishery 800 or 1,000 boats are required, and how could then the work be done with a limited number of 25 or 50.

4th Answer (*a*).—In the memoir already quoted a full and complete fishery is excepted from being rented.

(*b*) But the same rule might hold good even in a full fishery, for (1) as a fishery seldom lasts longer than 24 days, a rented fishery might last three times as long; (2) the bank which could not be open in one year, might be rented the following years, as the assertion of the Commissioners at the last fishery seems very improbable, that the oysters being too mature loosen the pearl and let it drop; this may be the case with some few of too full a growth, the place of which others will supply which were not so mature previously.

5th Objection.—It has just been answered to an objection, that what cannot be done in one year, may be done in the next one or two years immediately following, but since it has happened that there have been full fisheries for many successive years, how is it possible that these continued full fisheries could be carried on with a small number of dhonies? and then the loss to the company could be exceedingly great.

5th Answer (*a*).—A moderate profit in a rented fishery would be far more advantageous to the company than great *apparent* gain in an open fishery, at which if all matters would be weighed and balanced, the company really gains nothing; (*b*) it has not yet been proved that the oysters lose their pearls so quickly, and it is therefore uncertain if the company would sustain any injury by the delay.

6th Objection.—The renter will fish the banks so bare, that the profit of the company will be quite ruined.

6th Answer (*a*).—I cannot perceive why a small number of divers should strip the banks more than a greater number.

(*b*) If that idea should prove to be well founded, proper directions should be established on the subject, and it must be prohibited to bring up small or young oysters; and although it is desirable to get rid of the trouble of having constant guard over the banks, yet it would not be very difficult to have two or three persons commissioned to see what goes on.

7th Objection.—It will be necessary to inspect the banks in the same manner as previously, in order to know how the conditions of the rent are to be made out, for certainly speculators will make large or small offers according to the greater or fewer appearances of profit, and there will always be differences of opinion; for the renter will constantly urge that the duty was not well performed, in order to obtain some deduction for his amount of rent.

7th Answer (*a*).—The renter may have full liberty to obtain indemnification from the native inspectors, in the event of an incorrect report being given in by them.

(*b*) In the conditions care may be taken to guard against all after-claims, and to let the banks in whatever condition they may be found.

(*c*) Public notice may be given that persons inclined to make an offer for the banks may be present at the inspection of them.

8th Objection.—This rent will prejudice the chank fishery, for this latter will be at a stand-still from the want of divers.

8th Answer.—If divers can be found for 800 or 1,000 dhonies, then it can surely not be thought that they will be so scarce as not to be found for 50 boats, and both fisheries may easily go at the same time.

9th Objection.—The inspection of the pearl banks takes place in November, and it is late in December before the Government is able to make out the conditions of the fishery which is to be held in the middle of February. Now, it would be impossible to fix a day for offering the rent before the beginning of February, in order that speculators from the coast may have time to come to Ceylon. If then there should chance to be no speculators, or if they should not make an offer large enough, it would be too late to commence preparations for an open fishery, and Government would be compelled to be satisfied with a bidding however small, lest it should be deprived of the advantage of fishery on its own account or of letting out the fishery.

9th Answer (*a*).—It is not one instant to be doubted, but there will be a sufficient number of bidders; (*b*) at all events, even if they should bid little, and we should be compelled to accept their trifling offer, it would always be satisfactory to think that the gain is clear profit.

Finally, with respect to the Manaar and Calpentyn chauk-fishery, the Governor is of opinion that a diving on the company's own account would be far more profitable than renting the fishery, and if we resolved in our sitting on the 11th January last to rent that fishery again, it was because Mr. Raket, the Chief Officer at Manaar, was so indifferent upon the subject as to hold out no hopes of a successful attempt on our own account, yet we have since then given up renting that fishery, and it now takes place at our own risk, and although it is as yet not by any means so well conducted as it ought to be, still we by no means doubt but the company will derive a larger profit from it than 4,800 Rixdollars, which were offered for the rent of the last fishery.

The undersigned hopes he has now satisfactorily obeyed Your Excellencies' wish, and clearly proved first, that the renting of the pearl banks is in every respect preferable to having an open fishery; second, that it would be better to dive for the chauks at Calpentyn and Manaar on the company's own account.

APPENDIX E.

TABULATION OF THE RESULTS OF THE INSPECTIONS OF THE PEARL BANKS OFF THE INDIAN COAST OF THE GULF OF MANNAR, FROM 1885 TO 1903 INCLUSIVE.

(A continuation brought up to date of the records given in Mr. H. Sullivan Thomas' "Report on Pearl Fisheries", 1884.)

1. PAMBAN KARAI PÁR—
   1885. Nil.
   1886. Few oysters of $\frac{1}{2}$ to 2 inches, no value.
   1887. 117 dives; 6 oysters of $\frac{1}{4}$ to $\frac{1}{2}$ inch.
   1888 to 1894. Not examined.
   1895. Weed, chully and sea branch coral.
   1896 to 1903. Not examined.
2. PAMBAN VELANGU PÁR—
   1885. Weeds, no spat. Bare, 3 young oysters in 2 dives.
   1886. 31 dives. No oysters, much sea weed.
   1887. 59 dives; 5 oysters.
   1888 to 1894. Not examined.
   1895. Weed, chnily and sea branch coral.
   1896 to 1903. Not examined.
3. MUSAL TIVU PÁR—
   1885. False spat plentiful.
   1886 to 1894. Not examined.
   1895. A few young oysters, measuring $1\frac{1}{2}$ inch, on weed.
   1896 to 1903. Not examined.
4. CHOLAVA KARAI PÁR—
   1885. Weeds diminishing.
   1886 to 1894. Not examined.
   1895. Weeds and 6 young oysters.
   1896 to 1903. Not examined.
5. KILAKARAI VALLAI MALAI PÁR—
   1885. Killikoy; sea weed, useless.
   1886. Not examined.
   1887. Sixty-five dives, 4 oysters, averaging $\frac{1}{4}$ to inch in size.
   1888 to 1894. Not examined.
   1895. Red coral, weed, chully and shells.
   1896. Bare.
   1897. Blank.
   1898 to 1903. Not examined.
6. VALLAI MALAI KARAI PÁR—
   1885. Blank.
   1886. Not examined.
   1887. Twenty-one dives; blank.
   1888 to 1894. Not examined.
   1895. Red coral, weed, chnlly and shells.
   1896. Bare.
   1897. Blank.
   1898 to 1903. Not examined.
7. ANNA PÁR—
   1885. Blank.
   1886. Blank.
   1887. Twenty-five dives, blank.
   1888 to 1890. Not examined.
   1891. Six yonng oysters measuring from 1 to $1\frac{3}{4}$ inches, killikoy (small) and red branched coral. Sea weed and red coral.
   1892 to 1893. Not examined.
   1894. A few small oysters, measuring $\frac{1}{2}$ inch, on weed.
   1895. Red coral, weed, chully and shells.

7. ANNA PÁR—*cont.*
1896. Weed and chullies.
1897. Blank.
1898 to 1903. Not examined.

8. NALLA TANNI TIVU PÁR—
1885. Two examinations, sea weed only.
1886. Blank.
1887. Sixty-eight dives; weed and chully; 1 oyster of $\frac{3}{4}$ inch.
1888 to 1893. Not examined.
1894. Chully and weed.
1895. Three live oysters measuring 1 to $1\frac{1}{2}$ inch, sea weed, chully and red coral.
1896. Weed and chullies.
1897. Blank.
1898 to 1903. Not examined.

9. UPPUTANNI TIVU PÁR—
1885. Blank.
1886 to 1887. Blank.
1888 to 1893. Not examined.
1894. Chully and weed.
1895. One small oyster, red coral and sea weed.
1896. Weed and chullies.
1897. A few young oysters, average 8 to a dive, $1\frac{1}{2}$ to $\frac{1}{2}$ inch, very poor in condition and unhealthy looking, *probably due to the mud bank.*
1898 to 1903. Not examined.

10. KUMULAM PÁR—
1885. Blank.
1886. Thirty-four dives, no oysters; weeds and stones.
1887. Thirty-three dives, no oysters but weed and chully.
1888 to 1893. Not examined.
1894. Chully.
1895. Blank.
1896. Weed and chullies.
1897. Blank.
1898 to 1903. Not examined.

10 (*a*). VALINUKAM PÁR—
1885. A few killikoys.
1888 to 1890. Not examined.
1891. No oysters, small killikoys on red coral, 20 dives.
1892 to 1893. Not examined.
1894. Killikoy on red coral.
1895. Weed, red coral and one live oyster.
1896. Weed and chullies.
1897. Blank.
1898 to 1903. Not examined.

10 (*b*). VALINUKAM TUNDU PÁR—
1885. Bare.
1891. Quite bare, only chullies, 10 dives.
1894. Weed and 2 small oysters.
1896. Weed and chullies.
1897. Blank.
1898 to 1903. Not examined.

11. VEMBAR PERIYA PÁR—
1885. Blank.
1886. Seventy-seven dives, a few oysters $\frac{1}{4}$ to $\frac{1}{2}$ inch, plenty of sûran.
1887. Two oysters only found, no sûran, no value.
1888 to 1893. Not examined.
1894. One small live oyster, small quantity of spat on rock and weed, red coral and chully.
1895 to 1896. Not examined.
1897. A few young oysters $1\frac{1}{2}$ to $\frac{7}{16}$ inch in size.
1898. Not examined.
1899. Bare.
1900 to 1901. Not examined.
1902. No oysters, some sûran and mud.
1903. Not examined.

12. VAIPAR PERIYA PÁR—
1885. Not examined.
1886. Very few oysters of no value, plenty of sûran.

12. Vaipar Periya Pár—*cont.*
1887. Seven dives, blank.
1888–1893. Not examined.
1896–1903. Not examined.

13. Karai Pár—
1885. Probably affected by river water. Average 13 oysters to a dive, apparently new deaths.
1886. Seventy-eight dives, very old, empty dead shells and small coral stones. One oyster to a dive. Examined by "Pearl", no oysters, no sûran.
1894. Weed and chully.
1896. Oysters 1 inch in size, 5 per dive; several dead killikoy and a small quantity of small sûran.
1897–1903. Not examined.

14. Devi Pár—
1885. Four examinations; oysters plentiful but as many empty shells as live oysters.
1886. No oysters, no sûran; no oysters, plenty of sûran.
1887. Four oysters of $\frac{3}{4}$ to 1 inch, plenty of sûran, 33 dives.
1888–1890. Not examined.
1891. Forty-two dives, some sûran, 20 chanks.
1892–1893. Not examined.
1894. A good number of young oysters, average $\frac{1}{2}$ inch, killed by large sûran.
1895. False and true spat mixed.
1896. Oysters varying from $1\frac{3}{8}$ to $\frac{7}{16}$ inch in size, 7 to a dive, dead sûran but no dead oysters among them.
1897. Blank.
1898. Not examined.
1899. Bare; divers report that they found a large quantity of sand deposited on this bank.
1900–1901. Not examined.
1902. Very few one year old healthy oysters.

15. Pernandu Pár—
1885. Four examinations; oysters plentiful but as many empty shells as live oysters.
1886. No oysters, much sûran.
1887. Two oysters of 1 inch. This bank is now covered with sûran; 4 dives.
1888–1890. Not examined.
1891. Forty dives, no oysters; in some parts sûran.
1892–1893. Not examined.
1894. Blank.
1895. False and true spat mixed.
1896. Oysters ranging from $1\frac{1}{2}$ to $\frac{7}{16}$ inch in size; 6 to a dive. Dead sûran but no dead oysters among them.
1897. Blank.
1898. Not examined.
1899. Bare.
1900–1901. Not examined.
1902. Very few 1 year old healthy oysters.

16. Padutha Marikan Pár—
1885. Oysters plentiful but as many empty shells as live oysters.
1886. Found 11 dead oysters of 2 to $2\frac{1}{4}$ inches. Much weed in some places.
1887. Four oysters of $\frac{1}{2}$ and 1 inch on weed, no sûran.
1888–1890. Not examined.
1895. False and true spat.
1896. Oysters average 10 to a dive measuring $1\frac{1}{2}$ to $\frac{7}{8}$ inch Found oysters on dead pinna, also a large quantity of dead shells on sand. On north side of the bank found dead shells with dead sûran, also 2 live oysters $2\frac{1}{8}$ to $\frac{7}{8}$ inch on dead sûran.
1897. Blank.
1898. Not examined.
1899. Blank.
1900–1901. Not examined.
1902. Very few oysters 1 year old, healthy looking.

17. Padutta Marikan Tundu Pár—
1885. Two examinations, both found sûran only.
1886. Bare, all sûran.
1887. Sûran; 23 dives.
1888–1890. Not examined.
1891. Sixty dives, some sûran, no oysters.
1892–1893. Not examined.
1894. Blank.

17. Padutta Marikan Tundu Pár—*cont.*
1895. False and true spat mixed on weed and rock.
1896. (Same as Pár No. 16.)
1897. Blank.
1898. Not examined.
1899. Bare.
1900–1902. Not examined.

18. Tuticorin Kuda Pár—
1885. Pinna, sûran; oysters few; apparently a valuable bank.
1886. Found covered with sûran. No oysters, no sûran.
1887. Twenty-nine dives. One oyster of $\frac{1}{4}$ inch, sûran and weed.
1888–1894. Not examined.
1895. False and true spat mixed on weed and rock.
1896. One live oyster 1 inch, weed and red coral.
1897. Blank.
1898. Not examined.
1899. Bare.
1900–1903. Not examined.

19. Cruxian Pár—
1885. Chanks on rock, sûran, killikoy.
1886. One oyster $\frac{1}{2}$ inch, no sûran, 4 killikoys and a good deal of weed on rocky bottom. Sand on rock in many places; plenty of sûran.
1887. Seventy-two dives, 9 oysters varying in size $\frac{3}{4}$ to $1\frac{1}{4}$ inch; much sûran, killikoy.
1888–1890. Not examined.
1891. Plenty of sûran and killikoy.
1892–1893. Not examined.
1894. A few young oysters, average $\frac{1}{2}$ inch, on branch coral and killikoy.
1895. Young oysters averaging $1\frac{1}{4}$ inch in size, 5 to 7 per dive.
1896. A few young oysters $1\frac{3}{8}$ to $\frac{3}{8}$ inch. Dead chanks and pinna.
1897. Blank.
1898. Not examined.
1899. Bare.
1900–1901. Not examined.
1902. Estimated 1,700,000 oysters (healthy), $1\frac{1}{2}$ to 2 years old.

20. Cruxian Tundu Pár—
1885. Chanks on rock, sûran, killikoy.
1886. No oysters; 49 dives; no sûran. Much sûran and killikoy, also few oysters of $\frac{1}{4}$ inch.
1887. Forty-nine dives, 14 oysters of $\frac{3}{4}$ inch; much sûran and weed.
1888–1890. Not examined.
1891. Eighteen dives, sûran, no oysters.
1892–1893. Not examined.
1894. A few young oysters varying in size from $1\frac{5}{8}$ inch down. Sea weed; 5 live chanks and chully.
1895. Young oysters and a small quantity of sûran on the southern part of the bank.
1896. A few oysters measuring $1\frac{1}{2}$ to $1\frac{1}{8}$. Sûran on dead chank shells.
1897. Blank.
1898. Not examined.
1899. Weed, chullies, and some large live sûran.
1900–1901. Not examined.
1902. Estimated about 2,000,000 oysters (healthy), $1\frac{1}{2}$ to 2 years old.

21. Vantivu Arupagam Pár—
1885. Sûran.
1886. Twenty-three dives, no oysters, no sûran. Plenty of sûran.
1887. Twenty-five dives, sûran and weed.
1888–1890. Not examined.
1891. Twenty-five dives; sûran, no oysters.
1892–1893. Not examined.
1894. Weed, 8 live chanks. Chully and small killikoy.
1895. Young oysters, measuring $1\frac{1}{4}$ inch in size, 5 to 7 per dive and small quantity of sûran on the southern part of the bank.
1896. A few young oysters averaging 3 to a dive, $1\frac{1}{2}$ to $\frac{5}{8}$ inch on pinna and shells; found 10 oysters same size.
1897. A few young oysters mixed with dead shells.
1898. Weed and chullies.
1899. Weed, chullies and some large live sûran.
1900–1901. Not examined.
1902. Very few young oysters from 1 to $1\frac{1}{2}$ years old and healthy in scattered parts.

22. Nagara Pár—

1885. Bare.
1886. Plenty of oysters $\frac{5}{8}$ to $1\frac{1}{8}$ inch mixed with some empty shells. Five dives, some killikoys, no sûran, many dives, oysters of 1 inch in size and injured by fish. One chank with 8 oysters and some empty shells.
1887. Thirty-seven dives; 11 oysters of $\frac{3}{4}$ inch, much sûran and killikoy and weed.
1888. Not examined.
1889. Blank.
1890. Not examined.
1891. Fifteen dives, 7 chanks, 1 killikoy, some sûran; small pieces of stones; blank.
1892–1893. Not examined.
1894. A few yonng oysters varying in size from $1\frac{5}{8}$ inch down. Five live chanks and chully.
1895. False and trne spat, also young oysters varying from 1 to $\frac{1}{8}$ inch in size.
1896. Five to 7 oysters per dive, averaging 1 inch in size; dead shells of appearance only recently dead.
1897. Blank.
1898. Weed and chnlly.
1899. Weed, chnlly, and some large live sûran.
1900. Not examined.
1901. Large qnantity of dead and crushed young oysters.
1902. Estimated about 1,500,000 oysters $1\frac{1}{2}$ to 2 years old and healthy.

23. Utti Pár—

1885. Bare.
1886. A few oysters from $\frac{5}{8}$ to $1\frac{1}{8}$ inch, mixed with some empty shells 10 to 20 in a dive. Several dives made, a few oysters of 1 inch in size much mixed with dead shells.
1887. Twenty-six dives; much sûran and weed.
1888. Not examined.
1889. Blank.
1890. Not examined.
1891. Ten dives, 4 chanks, small pieces of stone, 1 young oyster, blank.
1892. One oyster $2\frac{1}{2}$ inch on chully, nothing more.
1893. Not examined.
1894. Sea-weed, chully, and small killikoy.
1895. False and true spat; also young oysters varying from 1 to $\frac{1}{8}$ inch in size.
1896. Ten oysters to a dive; old and young dead shells; oysters on live killikoy.
1897. Blank.
1898. Weed and chullies.
1899. Bare.
1900. Not examined.
1901. A few dead shells $\frac{3}{4}$ inch in size.
1902. Oysters found $1\frac{1}{2}$ to 2 inches, number not estimated. Healthy.

24. Udurvi Pár—

1885. Bare.
1886. One oyster 1 inch and a number of dead shells of no value, all sûran.
1887. Thirty-one dives, 40 oysters varying from $1\frac{1}{2}$ to $\frac{3}{4}$ inch.
1888. Not examined.
1889. Blank.
1890. Not examined.
1891. Seven dives; 3 chanks. Blank.
1892. Blank.
1893. Not examined.
1894. Sûran, sea weed and a few live chanks.
1895. False and true spat, also young oysters varying from 1 to $\frac{1}{8}$ inch in size.
1896. Bare.
1897. Blank.
1898. Weed and chullies.
1899. Bare.
1900. Not examined.
1901. Some young oysters, but 90 per cent. dead.
1902. Oysters plentiful, 2 years old and healthy. (*Sic*).

25. Kilati Pár.

1885. Sûran, a few empty oyster shells.
1886. (*a*) Plenty of oysters from $\frac{5}{8}$ to $1\frac{1}{8}$ inch; 11 dives; 40 to 50 oysters in a dive; no sûran or killikoy.
(*b*) Some oysters; divers got 20, 30 and 50 to a dive of 1 inch; many dead; bank of very doubtful value.
(*c*) Bank covered with sûran; no oysters.

25. Kilati Pár—*cont.*
- 1887. Thirty-nine dives, 5 oysters of $\frac{3}{4}$ to $1\frac{1}{2}$ inch, sûran, weed and killikoy.
- 1888. Not examined.
- 1889. Blank.
- 1890. Not examined.
- 1891. Twenty-two dives, 9 chanks, sand and small pieces of stones.
- 1892. Chullies—otherwise quite blank.
- 1893. Not examiued.
- 1894. Sûrau, sea weed and a few live chanks.
- 1895. Young oysters, 7 to 8 per dive, size 1 inch.
- 1896. A few young oysters, 1 inch in size. Weed, chullies and red coral.
- 1897. Blank.
- 1898. Weed, bare.
- 1899. Bare.
- 1900. Not examined.
- 1901. Some young oysters but 90 per cent. dead.
- 1902. Oysters in moderate numbers.

26. Attuvai Arupagam Pár—
- 1885. False spat plentiful.
- 1886. (*a*) Eleven dives, two of which oysters of $\frac{3}{4}$, 1, and $1\frac{1}{4}$ iuch were found.
  (*b*) Weed and some dead oyster shells; 2 oysters of $1\frac{3}{4}$ iuch.
  (*c*) All sûran.
- 1895. Blank.
- 1896. A few young oysters, 1 inch in size. Weed, chully and red coral.
- 1898. Blank, weed, bare.
- 1899–1900. Not examined.
- 1902. Not examined.

27. Attonpatu Pár—
- 1885. Two iuspections—chanks on rock and empty shells. No live oysters.
- 1886. (*a*) Eleven dives, no oysters.
  (*b*) No oysters or sûran, 65 dives made.
  (*c*) Sûran.
- 1887. No oysters—sûran dead in some places. 37 dives made; 1 chank.
- 1888. Not examined.
- 1889. No oysters, much sûran; 20 dives.
- 1890. Not examined.
- 1891. Twenty-nine dives; 44 chanks, small pieces of stones, sûran.
- 1892. Forty-four dives; live and dead sûran, chullies, 8 chanks.
- 1893. Not examined.
- 1894. Sea weed, chully, red coral, a few young oysters measuring from $\frac{3}{8}$ to $\frac{5}{8}$ inch.
- 1895. Blank.
- 1896. Four hundred and eighty-one dead shells, 78 live oysters, $\frac{4}{8}$ inch in size, the dead shells were found in perfect preservation, not snipped or fish bitten.
- 1897. Blank.
- 1898. Not examined.
- 1899. Blank. Weed and chully only.
- 1900. Not examined.
- 1901. Some few oysters, size $1\frac{1}{4}$ inch, 50 per cent. dead, mostly found on the sands and off the bank.
- 1902. Not examined.

28. (*a*) Pasi Pár—
(*b*) Pattarai Pár—
- 1885. Bare.
- 1886. No oysters, bank bare, 56 dives made.
- 1887. One oyster of $\frac{3}{4}$ inch. Pinna, chanks, and much sûran; 40 dives made.
- 1888. Not examined.
- 1889. Much sûran; no oysters; 20 divos.
- 1890. Not examined.
- 1891. Forty-four dives; bare.
- 1892–1893. Not examined.
- 1894. Sea weed and sûran.
  A small quantity of oysters varying in size from 2 inches to $\frac{1}{8}$ inch. Sea weed and a few chanks. One large oyster, 3 inches in size on rock.
- 1895. A few young oysters.
- 1896. Seven small oysters, chanks, chully and weed.
- 1897. Blank.
- 1898. Weed; bare.
- 1899. Blank; weed and chullies only.
- 1900. Not examined.

28. (*a*) Pasi Pár, etc.—*cont.*

1901. (28*a*) Large quantity of 6 months old dead oysters, in size $\frac{3}{4}$ inch, said to be killed by sûran, also dead sûran.

(28*b*) A few oysters, size $1\frac{1}{4}$ inch; 20 alive, 8 dead.

1902. (28*a*) Very few oysters, 6 months old, mixed with sûran.

(28*b*) Same as above.

29. Kutadiar Pár—

1885. Perfectly bare.

1886. (*a*) Nine dives—30 oysters of 1 inch in size, appear to be very few.

(*b*) Fifty-nine dives—a few oysters, many broken shells.

(*c*) Sûran; no value at present.

1887. Sûran, 2 chanks, 4 oysters of 1 inch on dead chank. Thirty-two dives made on this bank.

1888. Not examined.

1889. No oysters, much sûran; 17 dives.

1890. Not examined.

1891. Forty dives—pinna, 5 young oysters varying from $\frac{1}{2}$ inch to 1 inch in size, chully and pinna.

1892–1893. Not examined.

1894. Red coral, sea-weed, 2 live oysters, $2\frac{1}{4}$ to 2 inches in size—6 live chanks.

1895. Young oysters 10 to 15 per dive.

1896. A few oysters varying from $2\frac{5}{8}$ to $\frac{5}{8}$ inches in size.

1897. Blank.

1898. Weed; bare.

1899–1900. Not examined.

1901. No appearance of oysters.

1902. Not examined.

1903. Moderate number of very young oysters.

29-a. Wicks Bank—

1885. Two inspections; young oysters, size $\frac{1}{2}$ to $2\frac{1}{4}$ inch, plentiful, 2 chanks alive.

1886. Sixty-one dives; a very few oysters, size $\frac{1}{2}$ to $1\frac{3}{4}$ inch. A good number of pinna on the bank which is not of any great extent. Sûran; 2 dead chanks; 1 live chank; weed; 5 dead shells from 2 to $2\frac{1}{2}$ inch.

1887–1890. Not examined.

1891. Thirty dives, sûran in small quantity, seven live chanks, weed and one live oyster $1\frac{1}{2}$ inch in size.

1892–1894. Not examined.

1895. Four small oysters, large quantity of sûran, chully, and weed.

1896–1903. Not examined.

30. Tolayiram Pár—

1885. Seven inspections. Satisfactory, oysters clean and apparently growing well, free from trouble of any kind. The largest live oyster found measured 3 inches, average $2\frac{1}{4}$ inches; trigger fish; oysters covered with short sea-weed. Plenty of oysters from 2 to $2\frac{3}{4}$ inches.

1886. Large number of oysters $2\frac{1}{4}$ to $2\frac{3}{4}$ inches. The proportion of empty shells was trifling. This bank will be ready for a fishery in 1888. There seems to be much sûran round the bank and some of the oysters had it on them. The proportion of empty shells was trifling.

1887. Lifted 745 oysters, some sûran; 13 dead shells only found; plenty of fish.

1888. Plenty of oysters.

Lifted 15,000 oysters, dead shells few.

1889. This bank has been partially fished. Net profit to Government Rs. 1,58,483.

1890. Do. do. do. ,, 7,803.

1891. Ninety dives; a quantity of large sized dead shells; 2 live oysters, $2\frac{1}{2}$ to 3 inches in size; on a buoy which was placed to mark chanks in February last, found a large quantity of young oysters, $\frac{1}{8}$ to 1 inch in size; lifted the buoy carefully and placed it on the bank on rock. Examined the bank carefully but found no spat deposited. Am placing several more buoys as spat-catchers.

1892. One hundred and fifty-eight dives—8 chanks and a large quantity of full grown oyster shells and some weed. On examining the weed carefully through a magnifying glass found minute oyster spat. The spat-catcher buoys laid down last year were not to be found. They have unfortunately disappeared.

1893. Not examined.

1894. Old oyster shells, 2 live oysters measuring $1\frac{7}{8}$ and $\frac{1}{2}$ inch, respectively, live chanks, sea-weed, on which on careful examination small oysters measuring from $\frac{3}{8}$ inch downward were found; large sûran in small quantity, pinna and dead chanks.

1895. Northern portion quite bare, only chully. Southern part, sea weed with a few oysters varying from $2\frac{7}{8}$ to $\frac{5}{8}$ inch.

30. Tolayiram Pár—*cont.*

1896. Made 220 dives on this bank, result:—old oyster shells, branch sea-weed, red coral, 2 young oysters on rock measuring $1\frac{3}{4}$ and $1\frac{1}{2}$ inch.
1897. Old dead shells, weeds and chullies.
1898. Weeds and chullies; large sûran in some parts.
1899. A quantity of old dead oyster shells, chullies and sea-weed on the northern part. Found some small live sûran.
1900. Not examined.
1901. One of the largest banks. No appearance of oysters.
1902. Bare of oysters.

31. Vada Onpatu Pár—

1885. Bare; sea-weed, no spat.
1886. Thirty-two dives; no oysters.
1887. Fifty-four dives; sûran, 3 oysters of $1\frac{1}{4}$ inch.
1888—1890. Not examined.
1891. Sixty-two dives; 14 live chanks, pinna, chullies, no oysters.
1892–1893. Not examined.
1894. Bank free from sûran but nothing but sea weed on it.
1895. A few young oysters.
1896. A few oysters on southern side of this bank, large sûran on the western, rest bare.
1897. A few young oysters measuring from 1 to $\frac{5}{8}$ inch in size, 10 to a dive.
1898. Weed and chullies.
1899. Nine oysters $\frac{3}{4}$ to $1\frac{1}{2}$ inch in size, 6 dead shells, red coral and weed.
1900. Not examined.
1901. A few live oysters $1\frac{3}{8}$ and $1\frac{7}{8}$ inch; many of the clusters of oysters on the edges of the bank loose on sand.
1902. Not examined.

32. (*a*) Saith Onpatu Pár—
(*b*) Puli Pundu Pár—
(*c*) Kanna Puli Pundu Pár—

1885. Young oysters on sandy bottom attached to pinna shells, also on rock, all healthy looking; some sûran.
1886. Twenty-six dives—no oysters on Puli Pundu Pár or on Saith Onpatu Pár.
On Kanna Puli Pundu Pár, 2 oysters of $1\frac{1}{2}$ inch, some dead.
Oyster shells, 42 dives.
1887. Thirty-three dives made on the two latter banks; chanks, weed, 7 oysters of $2\frac{1}{2}$ inches in size.
1888—1894. Not examined.
1895. Young oysters 10 to 15 per dive.
1896. (32*a*) Bare.
(32*b*) Seventeen live oysters, one $3\frac{1}{2}$ inch, rest $1\frac{1}{2}$ inch. A large quantity of freshly broken oyster shells; no sûran or killikoy.
(32*c*) Do. do. do.
1897. A few young oysters mixed with dead shells, same size.
Oysters alive 31, dead 35; blank.
1898. Weed and chullies.
1899. Nine oysters $\frac{3}{4}$ to $1\frac{1}{2}$ inch in size, 6 dead shells and red coral and weed.
1900. Not examined.
1901. (32*a*) A few live oysters $1\frac{5}{8}$ to $1\frac{7}{8}$ inch; many of the clusters of oysters on the edges of the bank loose on sand.
(32*b*) Weeds small stones and no oysters.
(32*c*) Star fish, weeds and no oysters.
1902. Not examined.

33. Alluva Pár—

1885. Sûran, killikoy; useless.
1886. Twelve dives; no oysters.
1887. Thirty-two dives; 3 oysters of $\frac{3}{4}$ and 1 inch; sûran.
1888. Not examined.
1889. Nine dives; blank.
1890—1893. Not examined.
1896–1897. Do.
1898. Weeds and chullies.
1899–1902. Not examined.

34. Kanna Tivu Arupagam Pár—

1885. Blank.
1886. (*a*) Seven dives, no oysters.
(*b*) Twenty-six dives, no oysters, weed and chullies.
1887. Twenty-two dives, sûran.

34. Kanna Tivu Arupagam Pár—*cont.*
1888. Not examined.
1889. Fifteen dives, 5 young oysters of six months.
1890. Not examined.
1891. Large sûran in quantities, no oysters.
1892–1893. Not examined.
1894. Weed, chully and killikoy.
1895. Two small oysters, sea-weed, and a small quantity of small sûran.
1896. Sûran and killikoy.
1897. Oysters plentiful ranging in size from 2 to $\frac{1}{2}$ inch. They are unhealthy in appearance, very poor in condition. This is probably due to the adjacent mud bank.
1898. Weeds and chullies.
1899. Blank, nothing of value.
1900–1902. Not examined.

35. Tundu Pár—
1885. Blank.
1886. Thirty-five dives, no oysters, no sûran, no killikoy, some pieces of rock.
1887. Thirty-one dives sûran.
1888. Not examined.
1889. Seven dives, blank.
1890–1894. Not examined.
1895. Blank.
1896. Bare.
1897–1898. Not examined.
1899. Blank, nothing of value.
1900–1902. Not examined.

36. (*a*) Nenjurichchan Pár—
(*b*) Par Kundanjan Pár—
(*c*) Mela Onpatu Pár—
1885. Blank.
1886. (*a*) 13 dives, no oysters.
(*b*) Very few oysters—152 dives.
(*c*) The bank covered with sûran entirely; all stones, chanks, etc., thickly covered.
1887. No oysters, mud, suran; of no value.
1888. Not examined.
1889. No oysters, some sûran; 47 dives.
1890–1894. Not examined.
1895–1896. Bare.
1897. Blank.
1898. Bare.
1899. Blank.
1900. Not examined.
1901. (*a*) Weed, coral and small stones.
(*b*) Broken coral, small stones, no oysters.
(*c*) No oysters; weed and coral.

37. Pinnacoil Seltan Pár—
1885. A very small bank; bare.
1886. Bare.
1887. Twenty-two dives; blank.
1888–1890. Not examined.
1891. Two live chanks, one dead chank, two large dead oyster shells; chully and coral.
1892–1893. Not examined.
1894. Sea-weed, red coral, and chully.
1895. Young oysters, 10 to 15 per dive, with dead sûran mixed with young dead oyster shells.
1896. Oysters $1\frac{1}{4}$ inch, 5 to a dive on south-west side of bank; rest bare.
1897. Young oysters ranging from 1 to $\frac{2}{8}$ inch in size on weed.
1898–1899. Bare.
1900. Not examined.
1901. Weeds and stones, one healthy oyster, size 2 inches.
1902. Not examined.
1903. Bare of oysters.

38. Sandamaram Piditta Pár—
1885. Large sûran plentiful, also chanks.
1886. One diver brought 23 oysters $1\frac{1}{2}$ inch and again 10 of 1 inch, then got 20 to 30 each time, but the bank is of very small extent, and of no value.
1887–1890. Not examined.

38. Sandamaram Puditta Pár—*cont.*

1891. Forty-two dives; a small quantity of large and small oysters, oyster shells evidently old. Chully, red coral and a small quantity of weed.

1892–1893. Not examined.

1894. Sea-weed, red coral, and chully and two small oysters measuring $\frac{1}{2}$ inch.

1895. Young oysters 10 to 15 per dive.

1896. Seventy-seven oysters, average 2 to $\frac{3}{8}$ inch in size; chullies and weed.

1897. Oysters plentiful $1\frac{1}{2}$ to $\frac{2}{8}$ inch in size on weed, healthy in appearance, byssus strong; weed in large quantities.

1898. Oysters plentiful, 40 to 50 obtained at a dive. Divers report that oysters are firmly attached to bottom and it is only with a strong pull they can detach them. Size 2 to $2\frac{1}{2}$ inches.

1899. Bare.

1900. Not examined.

1901. Not examined.

1902. Not examined.

39. (*a*) Ira Tivu Kudamuttu Pár—
(*b*) Nadu Kudamuttu Pár—

1885. Quite bare, no sûran or killikoy; no spat.

1886. A few oysters of $1\frac{1}{2}$ inch with dead oysters and sûran. One part 15 and 20 to a dive intermixed with sûran; 43 dives made.

1887. Nineteen dives; bare.

1888–1890. Not examined.

1891. Two dives (*sic*); weed and chully.

1892–1893. Not examined.

1894. Sea-weed and red coral.

1895. Young oysters, 10 to 15 per dive.

1896. Bare.

1897. Same as No. 38.

1898. Same as No. 38.

1899. Bare.

1900. Not examined.

1901. Not examined.

1902. Not examined.

40. (*a*) Kovil Piditta Pattu Pár—
(*b*) Sanguria Pattu Pár—
(*c*) Nilam Kallu Pár—
(*d*) Sethu Kuria Pattu Pár—

1885. Blank.

1886. A few oysters on these banks of 1 and $1\frac{1}{2}$ and $\frac{1}{2}$ and $\frac{3}{4}$ inch, not sufficient to be of any value. One diver got 48; another 28, 92 dives made. On the part called Nilam Kallu Pár one diver got 9 oysters in two dives, another 7; 62 dives made on this Pár.

1887–1890. Not examined.

1891. Twenty-six dives; bare.

1892–1894. Not examined.

1896. Bare.

1897. Blank.

1898. Only chullies and weed, no signs of oysters.

1899. Bare.

1900. Not examined.

1901. Weeds, corals, and no oysters.

1902–1903. Not examined.

41. (*a*) Kudamuttu Pár—
(*b*) Rajavukku Sippi Sotichcha Pár—
(*c*) Saith Kudamuttu Pár—

1885. Blank; suran on the former, none on the latter.

1886. A few oysters $\frac{3}{4}$ to $1\frac{1}{2}$ inch; many broken and empty shells, sûran.
On Kudamuttu Pár five oysters of $1\frac{1}{4}$ inch; much sand on this bank, dead oyster shells of $\frac{3}{4}$ inch with weed, few oysters of 1 inch mixed with sûran; 68 dives.

1887. Thirty-one dives made on these banks.
On Kudamuttu Pár, 14 oysters of 1 inch; much sûran.
On Rajavukku Sippi Sotichcha Pár five oysters $\frac{1}{2}$ to 1 inch; sûran.
On Saith Kudamuttu Pár two oysters of $\frac{1}{2}$ inch; much sûran.

1888–1890. Not examined.

1891. (*a*) Thirty-four dives; five chanks, no oysters.
(*b*) Twenty-nine dives; five chanks, four oysters.
(*c*) fourteen dives; bare.

41. (*a*) KUDAMUTTU PÁR, ETC.—*cont.*

1892–1893. Not examined.

1894. Sea-weed, chully and red coral.

1895. Young oysters 10 to 15 per dive.

1896. Bare; sûran, dead oyster shells and a few young oysters.

1897. Large quantities of oysters on these banks measuring $1\frac{3}{8}$ to $\frac{5}{8}$ inch, healthy looking, byssus strong, free from sûran and with plenty of weed; on eastern edge large quantities of oysters were found on dead pinna and chank shells.

1898. Oysters varying from 2 to $2\frac{1}{2}$ inches, 40 to a dive among weed on rock, byssus strong, oysters healthy; very few dead and those evidently smashed by fishing stones.

1899. (*a*) and (*b*) bare; (*c*) only 24 oysters, $2\frac{3}{4}$ inch, were found.

1900. Not examined.

1901. (*a*) weed, coral, no oysters; (*c*) weeds and coral, 1 oyster.

1902. Not examined.

1903. (*b*) Very few six months old healthy oysters.

42. (*a*) NADU MALAI PIDITTA PÁR—
(*b*) PERIYA MALAI PIDITTA PÁR—

1885. Two oysters 2 inches and $\frac{1}{2}$ inch respectively only found on the former; the rest bare.

1886. 75 dives made on the former; two oysters of 1 inch, some empty shells of $1\frac{1}{2}$ to 2 inches, many chanks.
65 dives on the latter; bare.

1887. On Nadu Malai Piditta Pár 21 dives; blank.

1888–1893. Not examined.

1894. Red coral, sea-weed, four small live oysters averaging $\frac{5}{8}$ inch and a few live chanks.

1895. (*a*) Plenty of oysters, 104 to 106 per dive. Percentage of dead, small; oysters also on sand close to the bank. Young oysters 100 to 106 per dive; healthy looking.

1896. (*a*) and (*b*) 3 to 4 young oysters per dive.

1897. Not examined.

1898. Same result as No. 41.
(*a*) Oysters ranging from $1\frac{5}{8}$ to 2 inches in size 10 to 20 per dive, healthy and good.
(*b*) Oysters plentiful; 40 to 50 per dive; size 2 to $2\frac{1}{4}$ inches; healthy, byssus strong. No dead shells.

1899. (*a*) A few oysters, weed, chullies and pinna.
(*b*) Found only a few oysters on dead pinna and rock, found a very large quantity of cast-off byssus showing plainly that the oysters of last year had emigrated (!) (No; rather the ravages of *Rhinoptera* sp. J.H.).

1900. Not examined.

1901. (*a*) Weeds, coral, pinna; no oysters.
(*b*) Weeds, and coral, no oysters. In 1897 the banks were full of oysters. (This does not tally with the entry for that year! J.H.)

1902. Not examined.

1903. (*b*) Bare.

43. (*a*) KADEIYAN PÁR—
(*b*) KANAVA PÁR—
(*c*) PUTU PÁR—

1885. A few small live oysters.

1886. A very few oysters, many broken shells, weed, suran, and killikoy; one oyster of 2 inches; 54 dives.
On Putu Pár a very few oysters, varying in size from $\frac{3}{4}$ to 1 inch, empty shells, and weed on the bank; 40 dives.

1887. 174 dives made on these banks. On Putu Pár 71 oysters of $\frac{1}{2}$ to $1\frac{1}{2}$ inch; much suran in all parts.
On Kadeiyan and Kanava Párs seven oysters of $\frac{1}{4}$ to $1\frac{1}{4}$; much sûran.

1888–1890. Not examined.

1891. (*a*) and (*b*) 40 dives; four chanks, no oysters.

1892–1893. Not examined.

1894. Sea-weed and a few live chanks and chully.

1895. (*a*) On south side young oysters 10 to 15 per dive; young sûran.
On the northern side 40 to 58 per dive, free from sûran.
(*b*) Young oysters only 10 to 15 to a dive. Small sûran.
(*c*) Young oysters only 1 to 2 per dive.

1896. (*a*) 1 to 2 young oysters to a dive, also dead shells.
(*b*) and (*c*) A few young oysters.

43. (*a*) Kadeiyan Pár, etc.—*cont.*

1897. Large quantities of young oysters, healthy in appearance $1\frac{3}{4}$ to $\frac{5}{8}$ inches in size.
(*b*) and (*c*) Same result.

1898. (*a*) Oysters plentiful averaging 2 to $2\frac{1}{2}$ inches in size, healthy in appearance, byssus strong.
On western edge oysters were found in large numbers on pinna; oysters in abundance on the eastern and western edges—oysters in large quantities on pinna lying on sand, 2 to $2\frac{1}{2}$ inches in size.
(*b*) and (*c*) oysters plentiful—healthy in appearance; divers obtained 50 per dive, size 2 to $2\frac{1}{2}$ inches. No sûran or any trouble.

1899. (*a*) Almost bare—found only a few oysters on dead pinna and rock.
Found a very large quantity of cast off byssi showing plainly that the oysters of last year had emigrated. (!)
(*b*) Found a very large quantity of cast off byssi showing plainly that the oysters of last year had emigrated (!)
Eight oysters $2\frac{3}{4}$ inches in size and a few dead shells.
(*c*) Thirty-seven oysters of $2\frac{3}{4}$ inches and a few dead shells.

1900. Not examined.

1901. (*a*) Weeds, stones and no oysters.
(*b*) Weeds, stones and no oysters.
(*c*) Weeds, stones and 1 oyster 1 inch in size. In 1818 a fishery was held on this bank.

1902. Not examined.

1903. Bare.

44. Karai Karuwal Pár—

1885. Seven live oysters to a dive; empty shells, the largest, apparently fresh, measured $2\frac{1}{2}$ inches; empty shells intact. Much sûran.

1886. Broken shells; sûran; 1 live oyster, $1\frac{1}{2}$ inches.

1887. Not examined.

1888. Seven dives from canoes; weed, 1 oyster on sand.

1889–1890. Not examined.

1891. A few empty shells, 1 young oyster. 21 dives.

1892–1893. Not examined.

1894. Sea-weed, red coral, and chully.

1895–1896. Bare.

1897. Large quantities of young oysters, healthy in appearance, $1\frac{3}{8}$ to $\frac{5}{8}$ inch in size.

1898. Oysters plentiful, 35 to a dive, 2 inches in size; healthy.

1899. One hundred and seventeen oysters, $2\frac{3}{4}$ inches in size; among these 11 dead shells.

1900. Not examined.

1901. Coral, weeds, pinna; no oysters.

1902. Not examined.

1903. Bare.

45. Velangu Karuwal Pár—

1885. Oysters plentiful, measuring from $1\frac{3}{4}$ to $1\frac{1}{2}$ inches; 10 per cent. of empty shells. Some apparently bitten by fish and average 2 inches in size. Short sea-weed on oysters plentiful.

1886. In some parts there are oysters in fair quantities of $\frac{3}{4}$ inch; 10 and 20 to a dive, but many are already dead. Sûran exists, also the bank of little or no value. 92 dives. Last year's oysters all gone.

1887. Seventy-four dives; some empty oyster shells, 1 and $1\frac{1}{2}$ inches; weed, sûran, and round pieces of lime.

1888–1890. Not examined.

1891. (*a*) 63 dives; 5 oysters, 1 small dead oyster shell.
(*b*) 40 dives; chully, weed, coral, etc.

1892–1893. Not examined.

1894. Sea-weed, red coral, and chully.

1895–1896. Bare.

1897–1898. Same results as No. 44.

1899. Oysters $2\frac{5}{8}$ inches in size, 10 to a dive.

1900. Not examined.

1901. Coral, weeds and no oysters.

1902. Not examined.

1903. Bare.

46. Tundu Pár—

1885. Sea-weed and coral, nothing else.

1886. Eighty dives; 54 oysters of $1\frac{1}{2}$ inches in size, sûran; empty shells, all broken.

1887–1890. Not examined.

1891. Ten dives; chullies.

46. TUNDU PÁR—*cont.*

1892–1893. Not examined.
1894. Sea-weed, red coral, and chully.
1895–1896. Bare.
1897. Not examined.
1898. Oysters plentiful, 35 to a dive, 2 inches in size, healthy in appearance.
1899. Nothing of value.
1900. Not examined.
1901. Coral, weeds and no oysters.
1902. Not examined.

47. TRICHENDUR PUNTHOTTA PÁR—

1885. Blank.
1886. (*a*) Several dives; large number of oysters from $\frac{1}{4}$ to $1\frac{1}{2}$ inch attached to small coral stones, mixed with some dead shells; a very few weeds.
(*b*) Large number of oysters; the appearance of the oysters does not look healthy. Dead shells; several dives.
1887. Some empty oyster shells of $\frac{1}{2}$ to $\frac{3}{4}$ inch; no value.
1888–1890. Not examined.
1891. (*a*) Thirty-seven dives; small stones, and chullies.
(*b*) Twenty dives; weeds, coral, pinna, and chullies.
1892–1893. Not examined.
1894. Sea-weed, red coral, and chully.
1895–1896. Bare.
1897. Oysters plentiful, $1\frac{1}{2}$ to $\frac{5}{8}$ inch in size, healthy in appearance and in good condition. Divers brought up netsfull every dive, average 380 oysters.
1898. Oysters plentiful, 2 inches in size, on eastern and western edges. Oysters on pinna in large quantity. All healthy and free from any trouble.
1899. Oysters average $2\frac{1}{2}$ inches in size, 8 to a dive.
1900. Not examined.
1901. Coral, weeds and no oysters.
1902. Not examined.
1903. Do.

48. ODA KARAI PÁR—

1885. Bank measures $1\frac{1}{2}$ miles north and south; oysters sparse on rock, about 10 to 20 to a square yard; size 1 to $2\frac{1}{4}$ inches. Coloured red and like the coral to which they are attached.
1886. Forty-seven dives; last year's oysters are all gone. Now there are some young ones of $\frac{1}{2}$ and 1 inch; some dead shells also; divers got 11 live oysters of 1 inch, 13 and 8, most part are already dead.
1887. Fifty-five dives; one oyster of $1\frac{1}{2}$ inches, four dead oyster shells, $\frac{3}{4}$ to $1\frac{1}{2}$ inches. A large quantity of small round lime.
1888–1890. Not examined.
1891. One yonng oyster, four small dead oyster shells; 36 dives.
1892–1893. Not examined.
1894. A small quantity of empty oyster shells, weeds and coral.
1895–1896. Bare.
1897. Oysters plentiful; divers report that they could bring up basketsful at a dive. $\frac{3}{4}$ inch.
1898. Oysters 2 to $2\frac{3}{8}$ inches in size on weed and pinna, very healthy in appearance but quantity of broken shells shows that this bank lying close inshore and abounding in fish has been visited by fishermen.
1899. Oysters 20 to a dive, $2\frac{1}{2}$ inches in size; healthy. A very small quantity of dead shells were found; divers report that the undertow was very heavy, and that they had much difficulty in keeping on their feet; large quantity of weed on this bank.
1900–1902. Not examined.
1903. Bare.

48 (*a*). ODA KARAI TUNDU PÁR—

1885. *Nil.*
1886. Several dives; a very few oysters intermixed with many dead oyster shells; weed and chully.
1887–1894. Not examined.
1895–1896. Bare.
1897. Only a few young oysters.
1898–1903. Not examined.

49. CHODI PÁR—

1885. Bare.
1886. Fifty-two dives; no oysters, no sûran, etc.
1887–1890. Not examined.

49. Chodi Pár—*cont.*
1891. Twenty-two dives; a few dead oyster shells, no oysters. This bank in places is covered by coarse sand and shells about 6 inches deep.
1892–1893. Not examined.
1894. Quite bare, covered with coarse sand 1 foot deep.
1895–1896. Bare.
1897–1898. Not examined.
1899. Useless; covered with sand.
1900–1903. Not examined.

50. Sandamacoil Piditta Pár—
1885. Three or 4 to a dive.
1886. Large quantities of oysters of $\frac{1}{2}$ to $\frac{3}{4}$ and 1 inch. The divers brought up 6, 50, 21, 30, and 125 at a dive, some of $\frac{5}{8}$ inch. This is a valuable bank, but dead shells are already to be found; the oysters look clean and moderately healthy.
1887. This bank is also called "Surruku Onpatu Par." * A very few oysters on it.
1889–1890. Not examined.
1891. Large and small oyster shells, red coral, weed and chully; 42 dives.
1892—1894. Not examined.
1895–1896. Bare.
1897. Oysters plentiful; sizes ranging from $1\frac{1}{2}$ to $\frac{3}{8}$ inches; very few dead shells, no suran.
1898. Oysters plentiful; sizes ranging from $1\frac{6}{8}$ to $2\frac{3}{8}$ inches. Killikoy with oysters attached also found.
1899. Same results as No. 48.
1900. Not examined.
1901. A few scattered mature oysters.
1902. Not examined.

51. Teradi Puli Piditta Pár—
1885. Sea weed and old empty shells.
1886. Bare.
1887. Forty-six dives; blank; some false spat.
1888–1890. Not examined.
1891. Twenty dives. A large quantity of small dead oyster shells, pinna and weed, coral and chully.
1892—1894. Not examined.
1895. Sea weed only.
1896. Bare.
1897. Oysters plentiful, $1\frac{1}{2}$ to $\frac{3}{8}$ inches; very few dead shells, no suran.
1898. Same as No. 50.
1899. A very large quantity of oysters on this bank, 2 to $2\frac{1}{2}$ inches in size; divers report that they could bring up basketsful at a time; healthy in appearance with good strong byssi.
1900. This bank fished—supposed prematurely—poor prices fetched. Net profit to Government, Rs. 11,033.
1901. A few mature oysters; 10 per cent. empty shells; weeds 4 feet high in places.
1902–1903. Not examined.

52. Semman Path Pár—
1885. Sea weed; no spat.
1886. Blank. This bank is joined on to the large Manapad Par; is of no value.
1887. Seventy-two dives; blank.
1888—1890. Not examined.
1891. Eighty dives; chully, red coral, pinna, six live oysters from $1\frac{1}{2}$ to 2 inches; two live chanks.
1892—1894. Not examined.
1895–1896. Bare.
1897. Same result as No. 50.
1898. Weed and chullies only.
1899. Same result as No. 51.
1900–1903. Not examined.

53. Surukku Onpatu Pár—
1885. Six dives; three oysters of 2 inches, $\frac{3}{8}$ inch and $\frac{5}{8}$ inch, respectively; two kinds of sea-weed, tree and long, broad and flat leafed kind.
1886. 139 oysters from $\frac{1}{2}$ to $1\frac{1}{2}$ inches in size mixed with some recently dead oysters, chully and weed.
1887. Not examined.
1888—1894. Not examined.
1895–1896. Bare.

* No; they are distinct banks.—J.H.

53. Surukku Onpatu Pár—*cont.*
1897. Oysters plentiful $1\frac{1}{2}$ to $\frac{3}{8}$ inch. Very few dead shells; no suran.
1898. Not examined.
1899. Oysters 2 to $\frac{2}{8}$ inch; 10 to 15 per dive.
1900–1903. Not examined.

54. Manapad Periya Pár—
1885. Blank.
1886. No oysters; not a likely place at any time.
1887. Thirteen dives blank.
1888—1898. Not examined.
1899. Bare.
1900–1903. Not examined.

55. Kanawa Parakku Sohi Tundu Pár—
1896. Oysters ranging from $2\frac{1}{2}$ to 1 inch; 3 to a dive.
1897—1903. Not examined.

56. Paracherry Pár—
1885. *Nil.*
1886. Several dives. A very few oysters of $\frac{3}{4}$ inch. A large quantity of empty shells, weed, suran, and sponge.
1887. Thirteen dives; blank.
1888—1903. Not examined.

57. Paracherry Pathoor.

58. Alantalai Pathoor.

59. Manapad Pathoor.

60. Kili Pár.

61. Periya Talai Seman Terai Pár.

62. Seman Pallei Kathu Pár.

63. Kodoo Thalai Pár.

64. Ovaree Anthoniar Kovil Piditta Pár.

65. Ovaree Anthoniar Kovil Vellai Vallai Pár—
1899. Bare.
1900—1903. Not examined.

ANNEXURES.

Nos. I & II.—Sketch plans (Charts A and B) of the Central Pearl Bank region showing graphically the groups which I propose to form by the linking together of adjacent and related pars.

Nos. III & IV.—Similar sketch plans (Charts C and D) showing the manner in which I propose the Pearl Bank region should be examined by means of "circle-inspection".

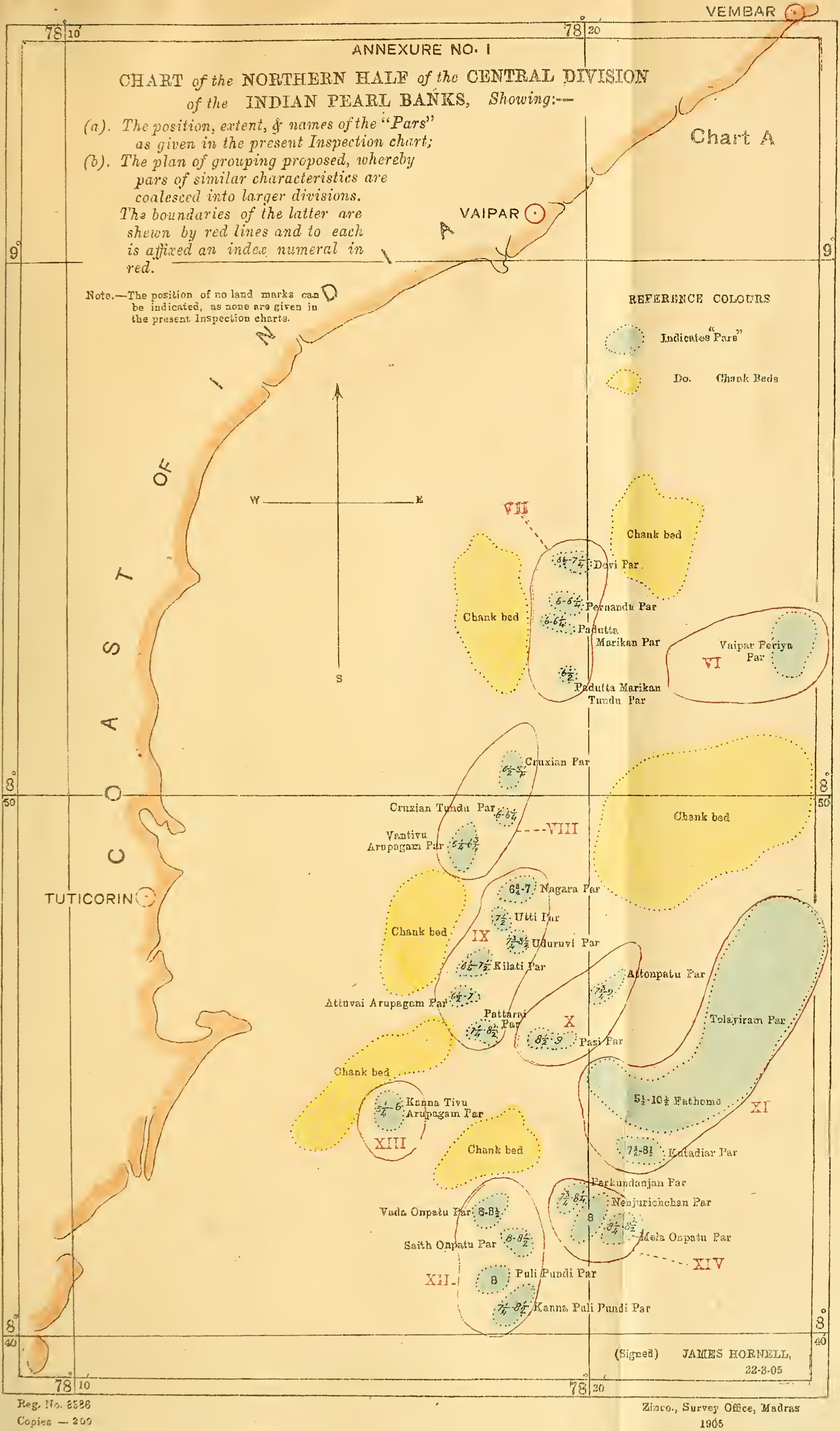
No. V.—Specimen of a Coxswain's inspection diagram, blank.

No. VI.—Specimen of the same filled up at the end of a day's work.

No. VII.—An example of one of the Inspector's master-diagrams filled up by combining the four diagrams furnished by the inspection coxswains.

No. VIII.—Skeleton diagram showing the sub-division of a large bank (Cheval Pár, Ceylon) into culture blocks.

No. IX.—Sketch-plan showing how the Skeleton plan No. VIII should be filled in after inspection has been completed, the distribution of oysters of different generations being indicated by distinctive colouring.



ANNEXURE NO. I
CHART of the NORTHERN HALF of the CENTRAL DIVISION of the INDIAN PEARL BANKS, Showing:—
(a). The position, extent, & names of the "Pars" as given in the present Inspection chart;
(b). The plan of grouping proposed, whereby pars of similar characteristics are coalesced into larger divisions. The boundaries of the latter are shewn by red lines and to each is affixed an index numeral in red.
Note.—The position of no land marks can be indicated, as none are given in the present Inspection charts.
Chart A
VEMBAR
VAIPAR
TUTICORIN
COAST OF INDIA
REFERENCE COLOURS
Indicates "Pars"
Do. Chank Beds
W
E
S
VII
Devi Par
Pernandu Par
Padutta Marikan Par
Padutta Marikan Tundu Par
Chank bed
VI
Vaipar Periya Par
Cruxian Par
Cruzian Tundu Par
Vantivu Arupagam Par
VIII
Nagara Par
Utti Par
Uduruvi Par
Kilati Par
Attuvai Arupagam Par
Pattarai Par
IX
X
Attonpatu Par
Pasi Par
Tolayiram Par
5½-10½ Fathoms
XI
Kutadiar Par
Kanna Tivu Arupagam Par
XIII
Parkundanjan Par
Nenjurichchan Par
Mela Onpatu Par
XIV
Vada Onpatu Par
Saith Onpatu Par
Puli Pundi Par
Kanna Puli Pundi Par
XII
(Signed) JAMES HORNELL, 22-3-05
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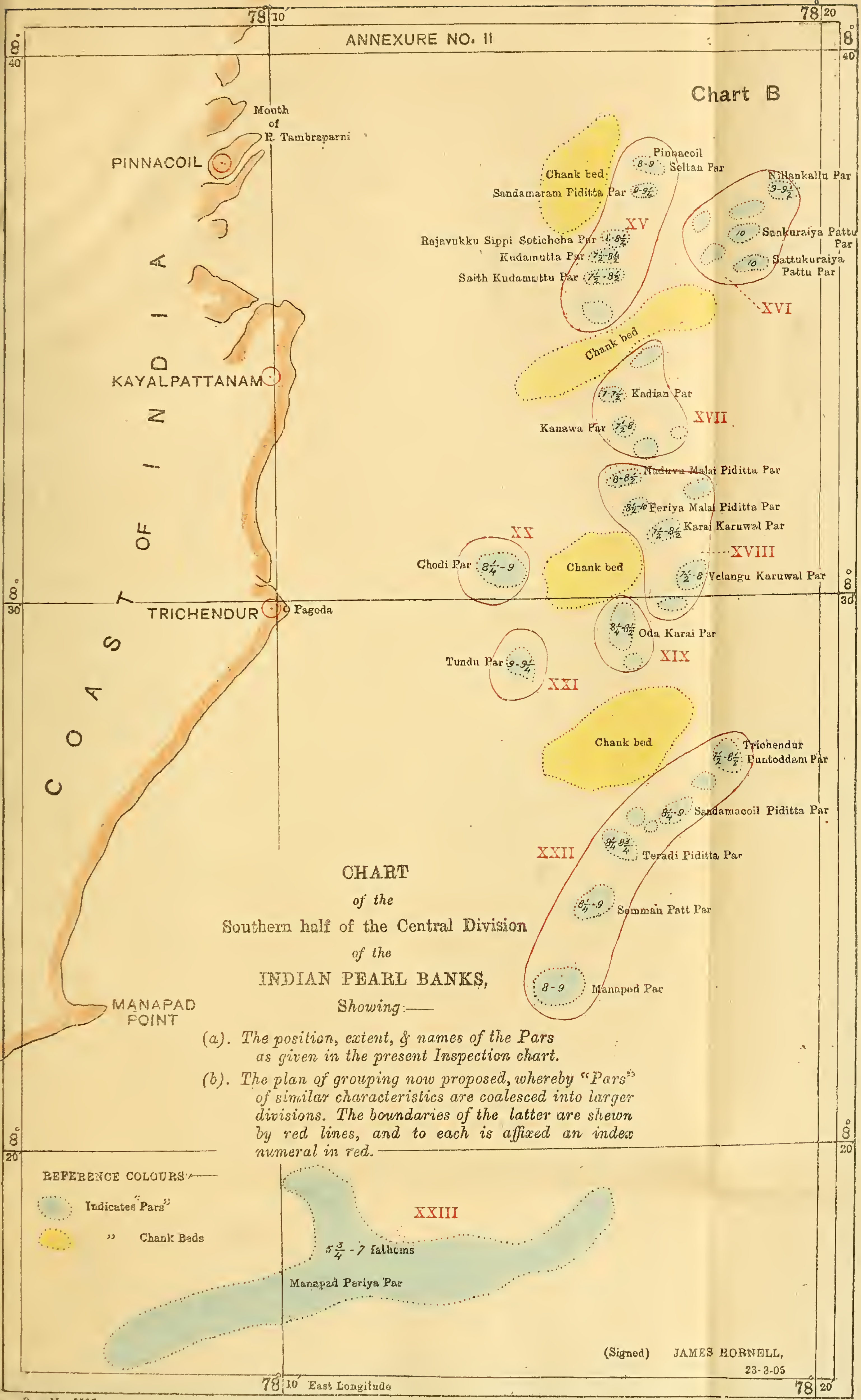

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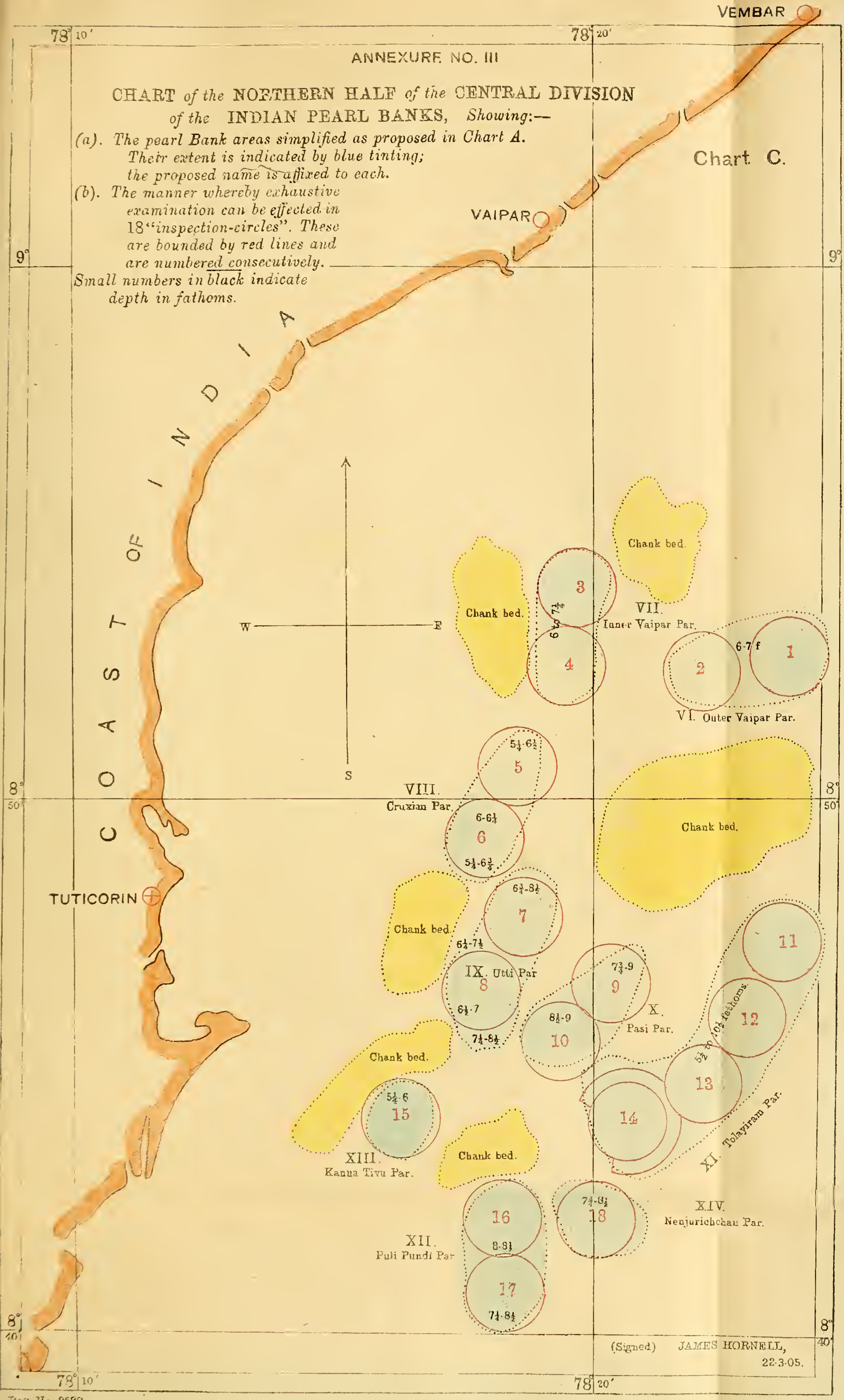

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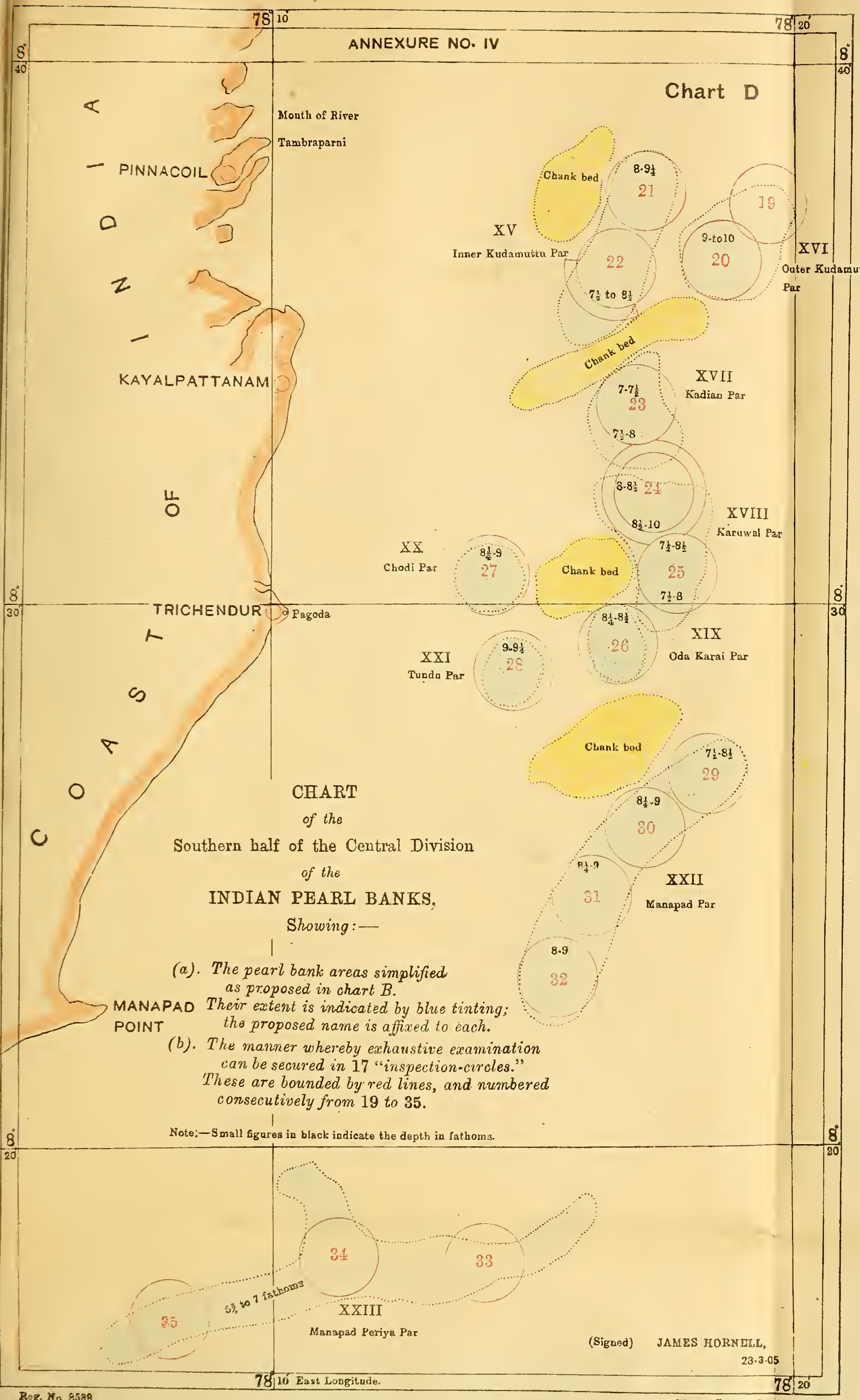

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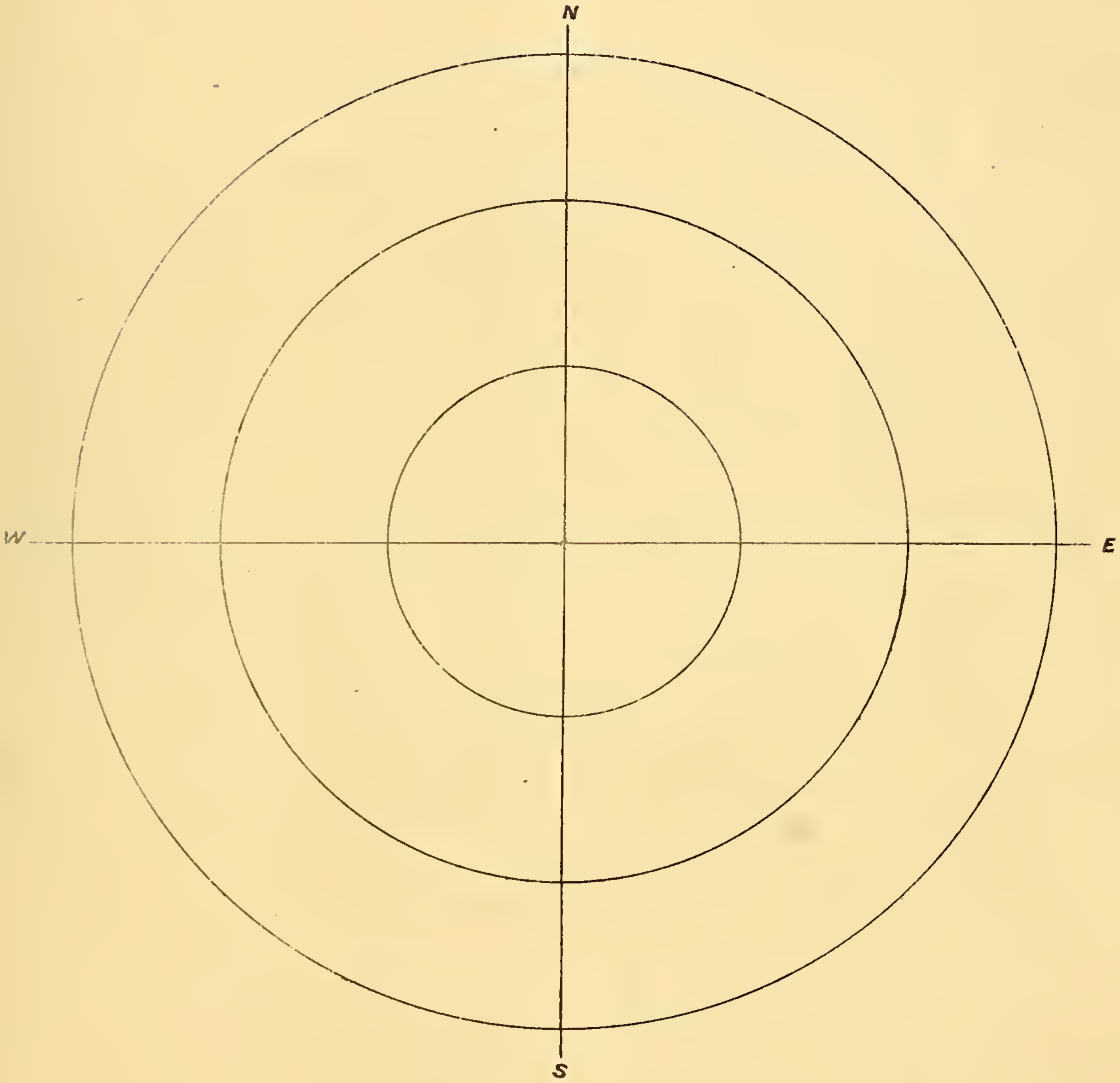
ANNEXURE NO. IV

Specimen of a Coxswain's
Inspection Diagram
before use.

.... *Par*

No. of Boat .... *Date* ....



Numbers above the line indicate Old Oysters.
,, below ,, ,, Young Oysters.
△ indicates flat rock.
× ,, Oysters too young to count.
○ ,, a sandy bottom.

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No. of dives on Old Oysters.........................

............do.............Young Oysters.........................

............do.............bare rock.........................

............do.............bare sand.........................

Total dives

No. of square yards.........................

No. of Oysters.........................

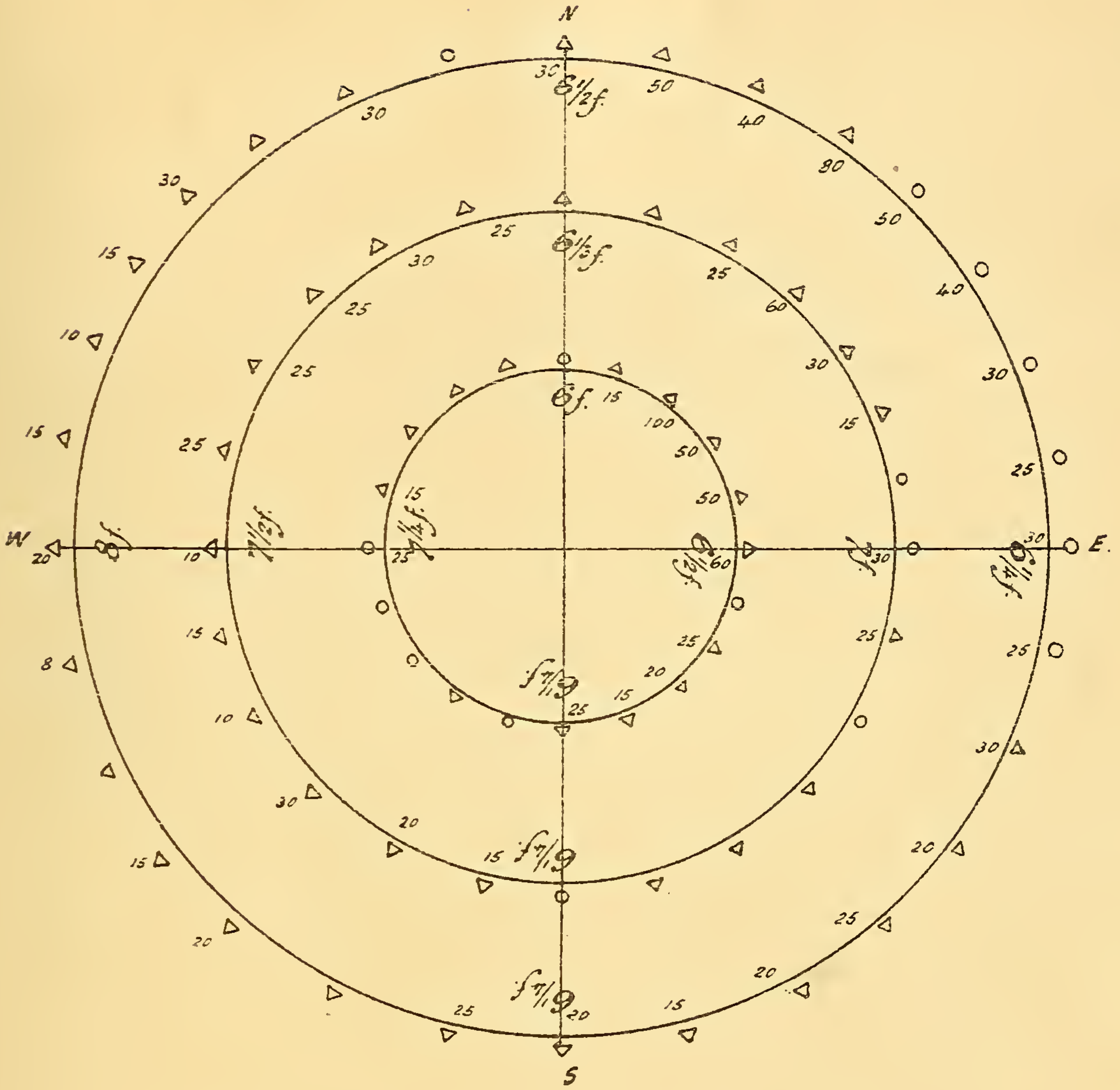
No. of Oysters to a dive.........................

ANNEXURE NO. V

No. 1.

Mid West Cheval Par

No. of Boat 4 — *Date 25th February, 1904*



Numbers above the line indicate Old Oysters.
" below " " " Young Oysters
△ *indicates flat rock.*
× *" Oysters too young to count*
○ *" a sandy bottom*

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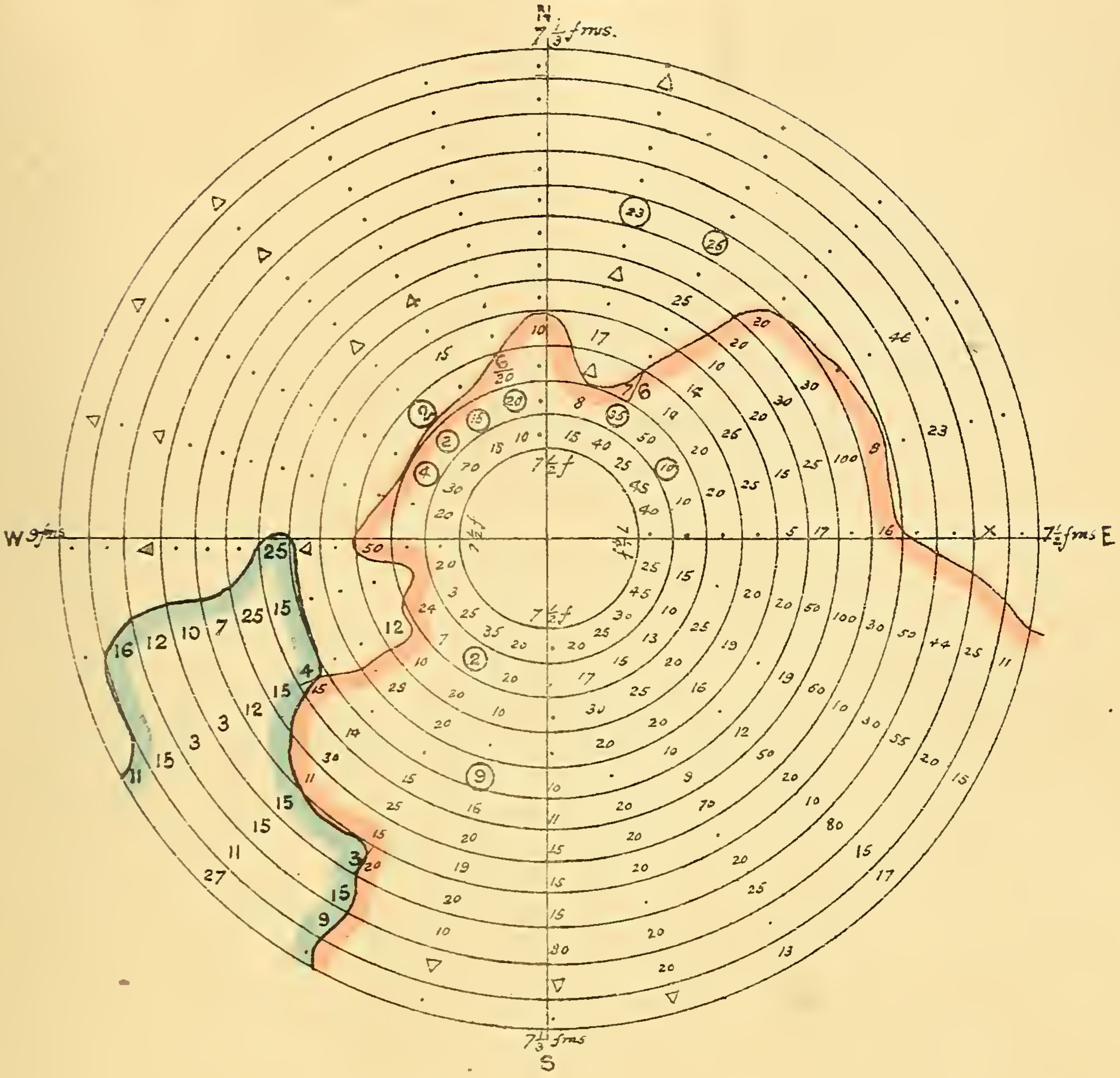
ANNEXURE NO. VII

Date 27th and 28th February 1904. N. W. Cheval Par

Bearings of landmarks from centre are:-

Karativu Pile Beacon, S. 31° E.
Kutiramalai Trigonometrical Tower, S. 33° E.
Kellar Beacon, S. 72½° E.



24. Numbers indicate Old Oysters .... } Upon Rock when the figures stand alone
12. Numbers indicate Young Oysters ..... } Upon Sand when contained within a circle
× indicates Oysters too young to count...

△ indicates that the bottom is flat rock } When Oysters are wanting.
· " a sandy bottom ....

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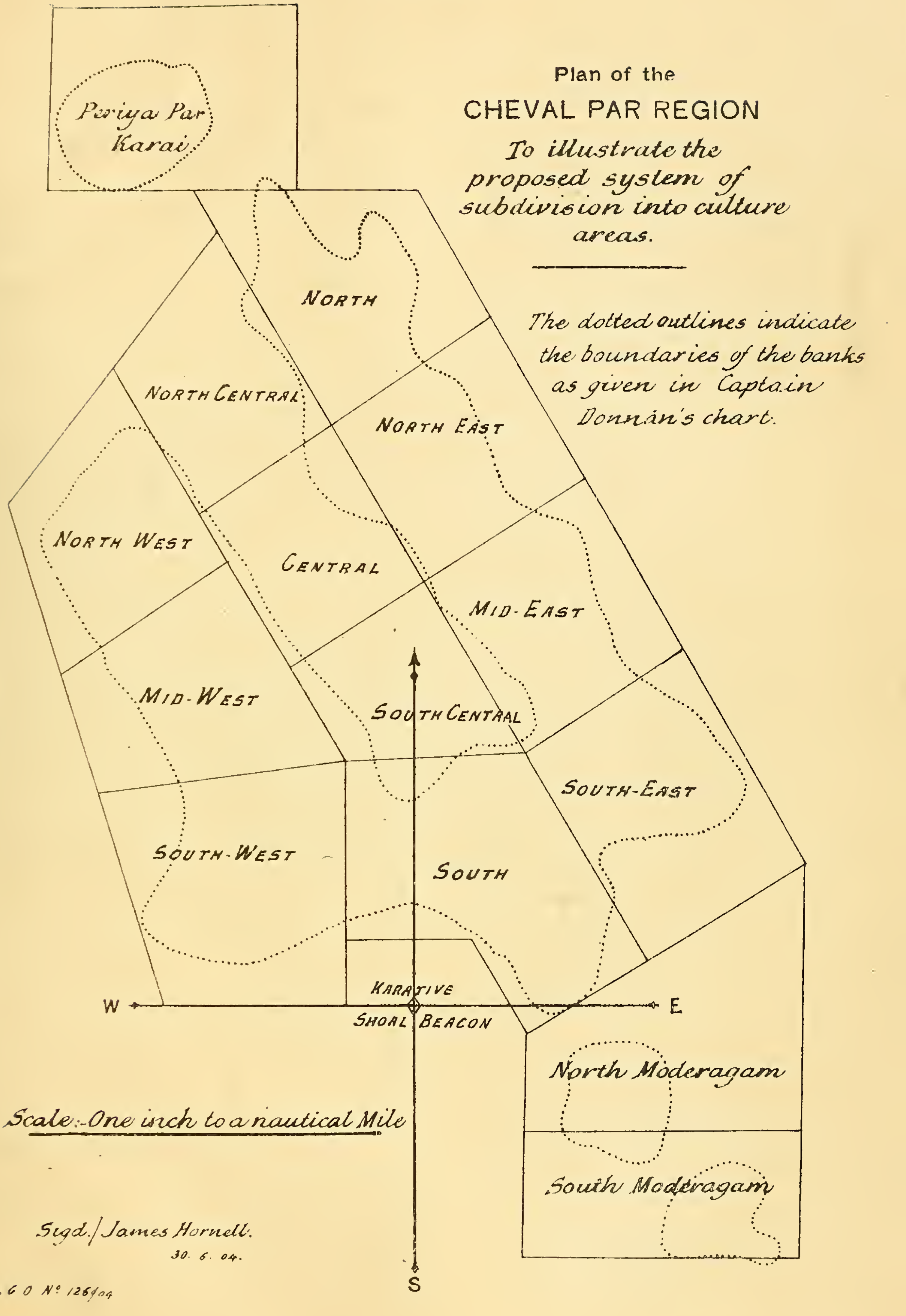
ANNEXURE NO. VIII

Plan of the CHEVAL PAR REGION

To illustrate the proposed system of subdivision into culture areas.



Sigd./ James Hornell.
30. 6. 04.

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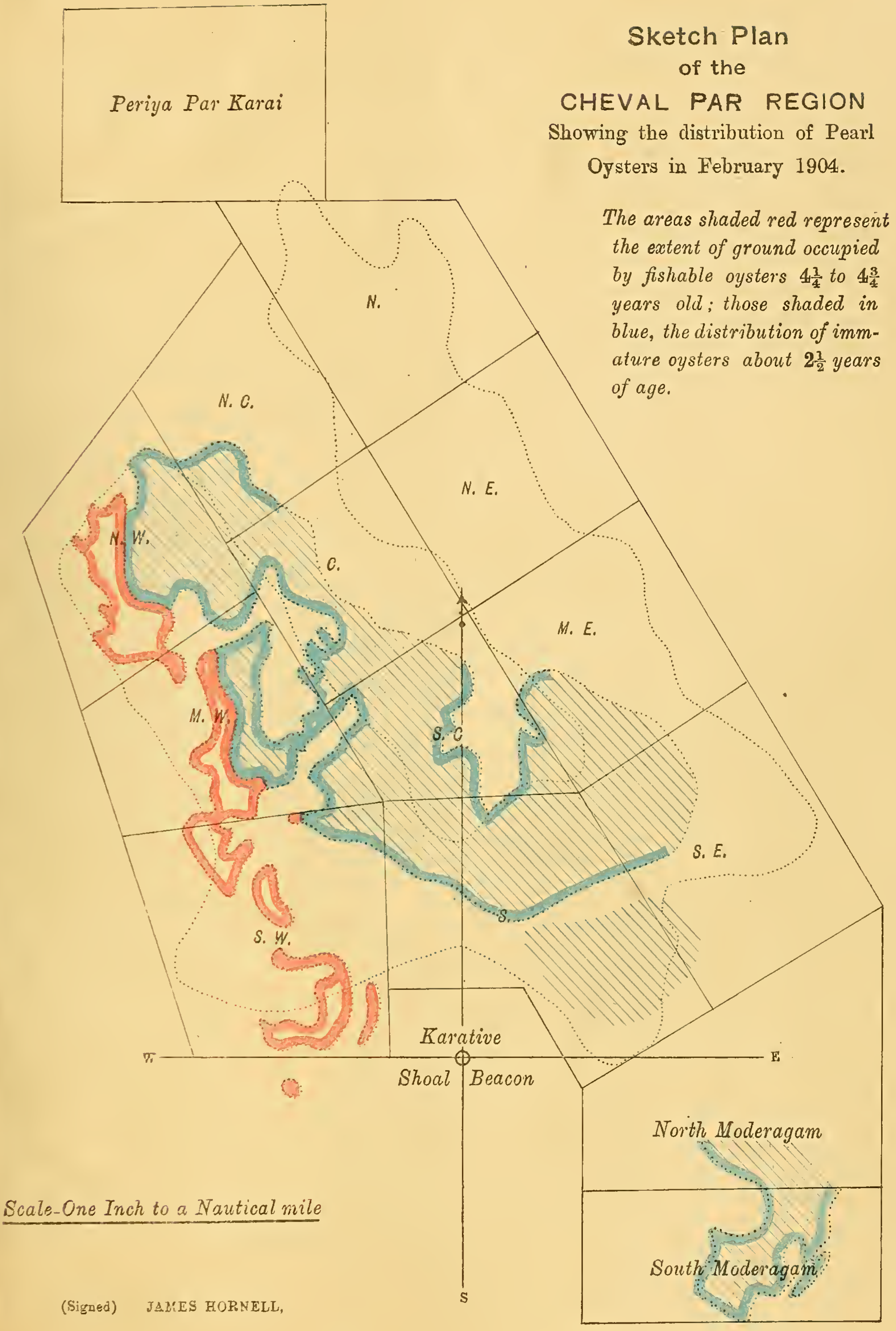

(Signed) JAMES HORNELL,

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